BULGARIAN FEDERATION OF SPELEOLOGY

CONTRIBUTION TO THE SCIENTIFIC STUDY OF ALBANIAN ALPS

REPRINTS OF THE ARTICLES RELATED TO BULGARIAN-ALBANIAN SPELEOLOGICAL RESEARCHES FROM 1991 TO 1996

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CONTENTS - PERMBAJTJA

1. Young tectonics and karst formation in the Albanian Alps by
Stefan Shanov - Geological Institute of Bulgarian Academy of Sciences

2. Relationship between geological, tectonic, climatic and hydrogeological conditions in the karst region Boga-Kozhnja, Albania by Ivailo Ivanon - Institute of Architecture, Civil Engineering and Geodesy.

3. Meteorite Ablation in karst medium(resume) by Alexey Stoev & Penka Muglova- Astronomical Observatory, Stara Zagora & Solar-Terrestrial Influences Laboratory of Bulgarian Academy of Sciences.

4. Temperature Anomalies Formation and Secular Instability Research of Ice of Atmospheric Origin in the Karst Caves of North Albania by Alexey Stoev & Penka Muglova and Dimitar Stoev - Astronomical Observatory, Stara Zagora & Solar-Terrestrial Influences Laboratory of Bulgarian Academy of Sciences.

5. Results from Bulgarian albanian Speleological researches in Albanian Alps from 1991-1996 by Alexey Jalov - Bulgarian Federation of Speleology.

6.Cyclopides (Crustacea, Copepoda) des eaux souterraines d'Albanie by
Dr. Ivan Pandurski - Institute of Zoology of Bulgarian Academy of Sciences.

7.Zooplankton from some lakes and ponds in North Albania with different size and Altitude by Dimitar Kozhuharov - Institute of Zoology of Bulgarian Academy of Sciences.

8.Notes on the Chilopoda of Albania by Pavel Stoev - National Natural History Museum of
Bulgarian Academy of Sciences.

9.Contribution to the knowledge of the harvestmen (Arachnida:Opiliones) of Albania by
Dr.Plamen Mitov - Department of Zoology and Antropology, Faculty of Biology, University of Sofia.

10.The millepedes of Albania:recent data, new taxa;systematical, nomenclatural and faunistical reveiw (Myriapoda, Diplopoda) by Jaen-Paul Maures-Loboratorire de Zoologie, Museum national d'Historie naturelle, Paris; Sergei Golovatch - Institute for Problems of Ecology and Evolution, Russian Academy of Sciences& Pavel Stoev - National Natural History Museum of Bulgarian Academy of Sciences.

11.Scorpions (Arachnida,Scorpiones) from the Balkan Peninsula in the collection of the National Museum of Natural History, Sofia by Victor Fet - National Research Council Washingtone, D.C., USA.
Institute of Zoology of Bulgarian Academy of Sciences.

12. *Albanotrecus beroni,* nuovo nenere nuova specie di Trechini cavernicoli di Albania(Coleoptera, Carabidae) by Achile Casale - Museo regionale di scienze naturali-Torino & Vassil Gueorguiev -Institute of Zoology of Bulgarian Academy of Sciencie

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Young tectonics and karst formation in the Albanian Alps

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Ст.Шанов – Молодая тектоника и карстообразование в Албанских Альпах. Анализирована структурно-тектоническая информация исследования карстового массива в Албанских Альпах, находящегося к северозападу от посёлка Боге. Массив сложен юрскими известняками, деформированными главным образом в конце эоцена. Водоносная система, развитая в нём, трещинно-карстового типа. Реконструированы направления главных осей тектонических напряжений s_1, s_2 и s_3, действовавших на массив с ранней юры до наших дней, полученные в результате анализа рассеивания пар трещин скалывания, тектонических штрих и механизма в очаге одного близкорасположенного к району исследования землетрясения. Деформации Пиринейской фазы, благоприятствовавшие открытию систем трещин направления СВ — ЮЗ, определяют главные черты развития карста в районе. В качестве второстепенных проявляются наложенные во время неотектонического этапа открытые системы трещин направления СЗ — ЮВ. Разрывные нарушения играют контролирующую роль для дренирования атмосферных вод и механического выноса раздробленного материала и вокруг них открываются глубокие до сотен метров пропасти, главным образом в сильно брекчированных зонах. Во время четвертичного периода скорость эрозии доминирует над процессом воздыгания массива и большинство поверхностных карстовых форм заполняется делувиальным материалом.

Abstract: Structural and tectonic information concerning the karstic massif in Albanian Alps situated NE from the Bogë settlement has been analyzed. The massif is built up of Jurassic limestones, deformed at the end of the Eocene. The type of water-bearing system is jointed-karstic. The direction of the principal tectonic stress axes σ_1, σ_2 and σ_3, having acted on the massif from Early Jurassic time up to present days have been determined by analyzing the dispersion of the pairs conjugate shear joints as well as tectonic striations and one fault-plane solution from an earthquake near the region of investigations. The Pyrenees tectonic phase deformations have favoured opening of the joint systems striking a NE-SW. Faults play a control role about atmospheric waters drainage as well as about mechanical transportation of debris and deep up to several hundred meter precipices open around them mainly in brecciated zones. The erosion velocity is dominating on the process of massif uplift during the Quaternary, and many of superficial karstic forms are filled up by deluvial material.

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Key words: karst process, young tectonics, Albanian Alps, tectonic stress fields

Introduction

The present investigation is a result of the analysis of the structural-tectonic information collected during a speleological expedition in the summer of 1994 in one region of difficult access in North Albania. The expedition was organized by Bulgarian Federation of Speleology. The main goal of the study is to show a strong influence of young tectonic processes on the formation of specific conditions of karst formation. The study has been performed on a scale 1:100 000, and the only available geological information was geological and hydrogeological maps of the Republic of Albania in scale 1:200 000. The geological map is worked out on a chronostratigraphic principle. Some corrections and specifications, concerning mainly the fault struc-

tures on the limited area of the investigations, were necessary during the field observations. The faults are conventionally named after settlements and geographical area names through which they pass.

Short geological and tectonic characteristics

The structural complex characterizing the exceptionally complex geological structure of the not so large Albanian territory is named by Albanian geologists as Albanides (Бичоку и др., 1978). The both basic megastructural units of the Albanides — North Albanides and South Albanides (related with the Helenides) are separated by the Shkodra — Pejio transversal zone representing an old paleogeographic province.

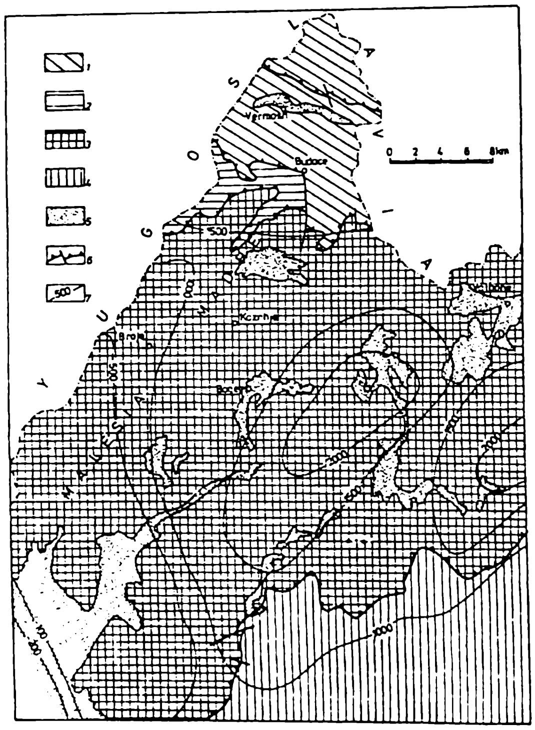

Fig. 1 Regional tectonic scheme of North Albania (after Biçoku, Aliaj, 1973 and Geological Map of Albania in scale 1: 200 000)
1 — zone Gashi — uplifted after Early Palaeogene; *2* — zone of the High Karst — uplifted after the end of Early Palaeogene; *3* — Albanian Alps zone — uplifted during the first half of the Palaeogene; *4* — Zone Krast-Cukali — uplifted during the second half of the Palaeogene; *5* — Neotectonic superimposed depressions; *6* — thrust fronts lines; *7* — isolines of the maximum upliftings during neotectonic stage (after Buçoku, Aliaj, 1973)

Albanian Alps zone (Fig. 1) is considered as a continuation of the High Karst of the Dinarides. The lower part of the geological section is represented by terrigenous sediments of Permian up to Lower Triassic age. They are covered by carbonate sediments. Their accumulation have begun during Middle Triassic. There are boxites formed in the same time. A continuos sedimentation of neritic limestones follows up to Maastrichtian time. Jurassic pelagic limestones with silicitics layers occur in the Eastern part of the Albanian Alps. This part (called also subzone Valbone) is considered as an independent transitional element of uplifted neritic Albanian Alps (Vermosh flysh) which covers a period from Maastrichtian up to Eocene.

At the end of Eocene time, the Albanian Alps zone have been deformed and thrusted to the South over the zone Krasta-Cukali. From structural point of view the Albanian Alps are a monocline dipping north-west. The big Valbone anticline is located to the north-east in its back, and the big syncline Malesia-Madhe is situated to the north-west.

The region in which the expeditions of the Bulgarian Speleological Federation worked during the four consecutial years (beginning from 1990) is a part of the North Albanides. According to the age of the more intense folding, the region belongs to the areas deformed at the end of Eocene time. More detailed structural and tectonic investigations in 1994 have been carried out on the territory belonging to the SE limb of the syncline Malesia-Madhe, and especially near its axial part. The geology of this territory is represented mainly by carbonate complexes of Lower Jurassic up to Lower Cretaceous (Baremian-Aptian) age.

Different-order faults determine the formation of the tectonic block structure of the limestone massif. Those are long-term acting faults with quite explicitly manifested neotectonic activity affecting the relief and the karstic processes in the region. The recent activity of some of the faults is manifested by concentration of earthquake foci along them (Fig. 2). The fault Rapsh-Boçani is quite active during the recent tectonic stage (No. 4 on the Fig. 2 and Fig.3). It is clear, that energy accumulation occurs along this fault, periodically being released by earthquakes in the zones of its crossings with other regional faults (e. g. with fault No. 1 — Pjetroshan-Veliçikut-Kozhnje, or with fault No. 3 — Bogë-Budace). Following the most general considerations reflected on the geological map of the region, it could be assumed that in the contemporary tectonic stage there is an uplift of Northern fault wall and subsidence of the Southern one. This is a continuation of the tendency of

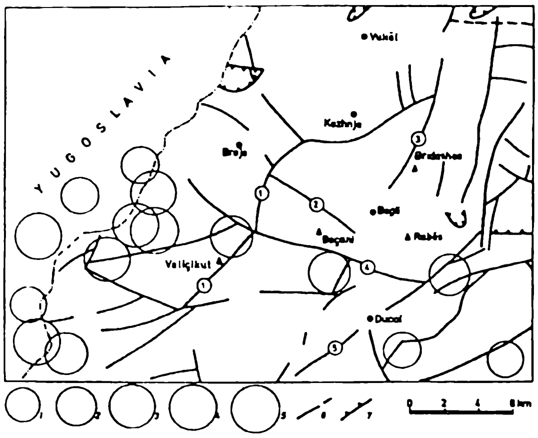

Fig. 2. Main fault structures in the investigated region and epicentres of recorded earthquakes for the period 1961 — 1988. Earthquake magnitudes: *1* — M < 2.0; *2* — M = 2.1 — 3.0; *3* — M = 3.1 — 4.0; *4* — M = 4.1 — 5.0; *5* — M = 5.1 — 6.0; Faults: *6* — normal faults; *7* — thrusts. More important regional faults: 1 — Pjetroshan-Veliçikut-Kozhnje; 2 — Dobromiri; 3 — Bogë — Budaci; 4 — Rapsh — Boçani; 5 — Ducal

neotectonic development of the region which predestines the contemporary relief. The neotectonic stage of the Albanian Alps development is marked by intense uplift whose total amplitude in some parts is more than 200 m.

Geological and hydrogeological conditions of karst formation

During the whole Mesozoic after Early Triassic time, the sedimentation conditions existing almost continuously up to the beginning of Maastrichtian have resulted in the formation of a thick limestone complex. The following tectonic development during the Alpine tectonogenetic phases and especially the expressed overthrusting of a part of the limestones complex to the South, have increased the complex thickness. The neotectonic uplift and denudation have led to the contemporary complex relief, with altitudes exceeding 2000 m. It could be supposed that the thickness of the carbonate rocks, now subjected to karstification, is more than 1500 m. This supposition is argumented by the concentration of big karstic springs at altitude of some tens meters over the sea level and running out of impressive quantities of fresh water in Shkodra Lake and Adriatic Sea. The tectonic factor should be also taken into account. It comprises fault sets that facilitate the drainage of superficial water outflow occurs by channels which do not allow always the formation of karstic cavities.

According to the Hydrogeological map of Albania, the fault marked by line Pjetroshan-Veliçikut-Kozhnje plays a role of main distributor of underground water outflow in the region localized West — Northwest from the Bogë settlement. There are concentrations of karstic springs at the Northwestern fault wall. Probably, an enormous underground water flow is drained by the same fault, coming out on the surface near the village of Pjetroshan by a well-developed karst spring system. One of the springs has a debit up to 4 m^3/sec.

In the same time, the Southeastern fault wall constituted by faulted blocks supplies all conditions needed for draining of huge superficial water quantities (most of all atmospheric) and their running towards the drainage zone. According to the Hydrogeological map of Albania in scale 1:200 000, the investigated region is localized in joints-karstic type of water-bearing system having an effective infiltration ratio about 0.6 — 0,7. In these conditions the atmospheric waters penetrate fast in the water-bearing system and flow towards their natural drainage level. In this way, no conditions stimulating horizontal karst system developing could practically exist. The conditions for vertical channels-precipices are much better. Several expeditions of the Bulgarian Speleological Federation just prove the mass development of precipices reaching depths from tens up to 500 m.

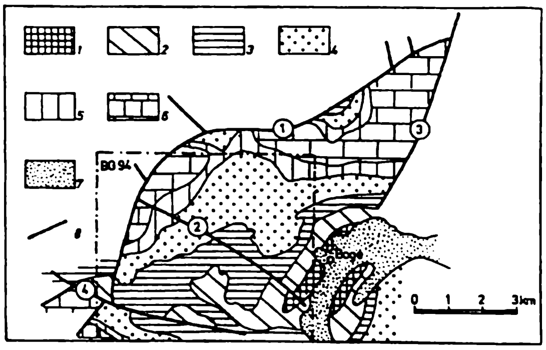

Fig. 3 Geological scheme of the investigated territory NW of the Bogë settlement (North Albania), carried out on the base of Geological Map of Albania in scale 1:200 000. The rhomb sighed BG94 is the region of investigations of the Bulgarian expedition during 1994
1 — Upper Triassic limestones and dolomites; *2* — Lower Jurassic limestones and dolomites; *3* — Middle — Upper Jurassic undivided limestones and dolomites; *4* — Upper Jurassic limestones and clay sands; *5* — Tithonian limestones; *6* — Lower Cretaceous limestones, carbonate limestones, clay sands; *7* — Quaternary sediments in superimposed depressions; *8* — faults: 1 — Pjetroshan-Veliçikut-Kozhnje; 2 — Dobromiri; 3 — Bogë — Budace; 4 — Rapsh — Boçani; 5 — Ducal

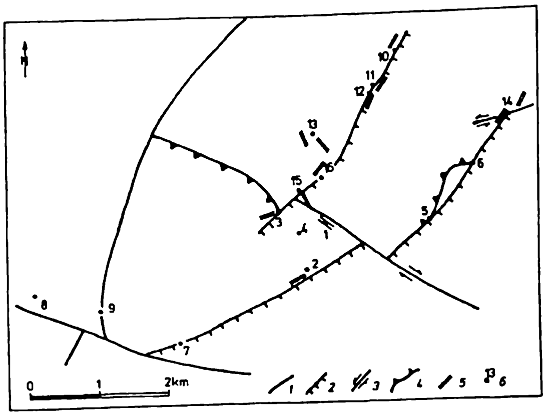

Fig. 4. Scheme of fault ruptures in the region investigated in 1994, points of structural measurements and base karst forms orientations on plan. *1* – fault with undetermined type of displacements; *2* – normal fault; *3* – strike-slip fault; *4* – thrust; *5* – points of structural measurements. Faults: 1 – Pjetroshan-Veliçikut-Kozhnje; 2 – Dobromiri; 3 – Rapsh – Boçani

The speleological as well as the structural-geological investigations in the karstic massif to the North-West of Bogë settlement (Fig. 3) clarified additionally some problems and showed a strong significance of the fault tectonics as a factor for precipices and caverns formation in the most fragmented zones by young displacements.

The measurements of the space elements of joint systems and 'tectonic striations on different surfaces of outcrops have been carried out only at 16 points (Fig. 4) because of relief complexity, its difficult passibility and the limited time for field observations. The information turned to be sufficient for reconstruction of the main tectonic deformation phases after Early Jurassic times up to present days which determine the main relief characteristics as well as the superficial and underground karst features.

Investigation methods

Three basic methods are used for the reconstruction of the tectonic stress field principal axes reconstruction in the region studied. Detailed analysis of the final results from each observation point allowed to distinguish the different deformation phases expressed in the structure of the joint systems of the karstic massif and controlling the basic characteristics of the karstic processes and to determine their age.

1. Fault-plane solutions from earthquakes

This is the most precise method for determination of the principal axes of the youngest tectonic stress field. It is easy to determine P (compression) and T (tension) axes of the recent tectonic stress field in the Earth's crust by this method. Only one mechanism was available for the purposes of the present investigation, i. e. an earthquake with magnitude M=5.1 (03 November 1968) and epicentre localized to the South-West of the studied region ($\lambda° = 42.10°$, $\varphi° = 19.35°$). These data are taken from the paper of Muço (1994).

2. Tectonic stress field reconstruction from striations on slickensides

These investigations take the most significant place in the collected information because in 11 points of structural investigations indicators of displacements on the joint and fault surfaces have been found out – exceptionally well-preserved tectonic striations covering in some cases surfaces of several square meters. This type of reconstructions correspond to a mesoscopic level of rupture structures and the kinematic characteristics of the rock block displacements are used. The methodology (Caputo, 1990) requires strict determination of the elements of the displacements on the friction surface.The computer program for data processing and analysis was kindly given by R. Caputo (University of Florence, Italy) to the Geological Institute of the Bulgarian Academy of Sciences.

3. Reconstruction of the tectonic stress fields from tectonic jointing

This study has been carried out following method of Nikolaev (Николаев П. Н., 1977), which has been commented and adopted for computer based use (Шанов, Стоянов, 1986) and successfully applied in a number of karst regions in Bulgaria, France and Cuba. The method is built up on a basic principle, i. e. the pair of systems of conjugate shear joints appearing simultaneously at a certain tectonic stress field shows some dispersion towards the minimum main principle stress axis σ_3. In statistical estimations of mass measurements of joint elements of a certain outcrop this is expressed by well-observed in the distribution of maxima, thus allowing for an undoubted identification of the principal stress axes. One of the handicaps of this method is that it is difficult to differentiate in a given rock massif more than 3 or 4 tectonic influences. In the region studied mass measurements of joints have been carried out in 4 points.

Investigation results

Structural investigations applied for rock formations of different age (but within the Jurassic Period) allow to differentiate by time reconstructed tectonic stresses. Figure 5 shows dia-

grams of the reconstructed tectonic stress fields in the measurement stations, which are related to a certain tectonic phase of a global scale. This turned out to be the most logical scheme when interpreting and comparing reconstructions in Jurassic limestones of different age.

The youngest (Quaternary and recent) tectonic stress field is defined by the mechanism solution of the only available earthquake focus near the territory studied. Its features (NW-SE compression and NE-SW tension) could be found out in reconstructions in points 13 and 14. This field is characterized by exchanged stress axes compared with those of Neotectonic (post-Miocene) stage, where minimum tectonic stress σ_3 of NW-SE to E-W trend has determined formation of neotectonic superimposed depressions generally elongeted towards NE-SW (see Fig.1). The compression was subvertical (uplifting) and it is well-expressed by the striation on the tectonic slickenside of point 13.

The most considerable deformations can be referred to the Pyrenean phase (end Eocene). Then, under the conditions of strong pressure of almost North-South direction (see points 5, 10, 12, 13, 15, 4 and 9) a Southward trusting of the Albanian Alps zone onto the Krasta-Cukali zone occurred. After the Middle Jurassic times, young Cimmerian, and after that, Laramian tectonic deformations affected the massif of limestones and dolomites. Clear reconstructions in points 13, 14, 16, 4, 2, 7, and 8, are an evidence of this. The Laramian phase is characterized by a strong sub-horizontal (except p.7) North-West — South-East trending minimum principle stress σ_3. The young Cimmerian phase has features which are very similar to the contemporary tectonic stress field. Taking into consideration that during the Pyrenean phase the whole massif has been displaced to the South, presumably with some rotation, both most ancient phases possess an element of relativity in reconstructed directions of tectonic principle stress axes.

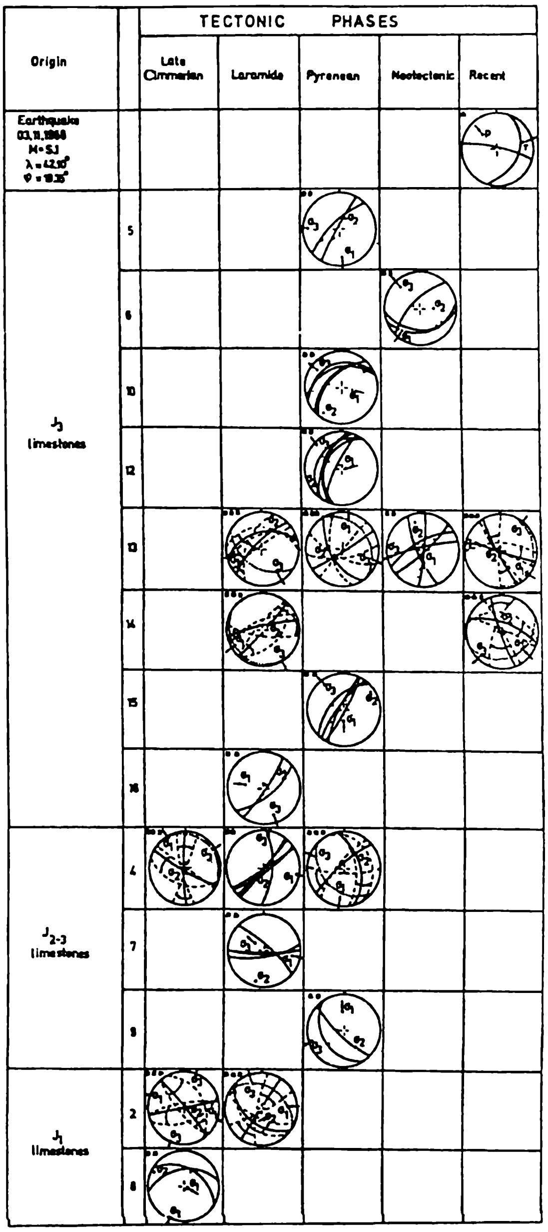

Fig. 5. Reconstructions of tectonic strength field principle axes during different tectonic phases in the investigated region of the Albanian Alps. All stereograms are given in upper hemisphere projection.
* — after earthquake fault-plane solution; ** — after tectonic striations; *** — after shear joints systems.
σ_1 — maximum principal stress axis; σ_2 — intermediate principal stress axis; σ_3 — minimum principal stress axis; P — axis of maximum compression in the earthquake focus; T — axis of the tension in the earthquake focus.

Relations between karst formation and concrete tectonic conditions

The first step for determination of tectonic factors influencing karst formation is the analysis of the principal stresses, that have led to the now observed structural ruptures in the investigated massif, described above. The karst formation has started most likely after Eocene-Oligocene times. By this time, the displacements of

the limestone massif to the South had calmed down, and its intense uplifting started.

The detailed observations carried out in the points of reconstruction of the tectonic stress field have resulted in some changes of the ideas concerning the fault network of the area. On the one hand, the normal faults are complicated by strike-slip displacements, being of the youngest age, and they correspond to the youngest (contemporary) tectonic stress field (Fig. 4).

The well expressed thrust structures (points 3, 5 and 6) appear as relicts of the Laramian tectonic phase deformations. In the zones of shear and mylonitization there are conditions for formation (mainly because of mechanical export of particles by the water) of small horizontal cavities, which seldom reach more than several tens of meters (for example in points 5 and 6). Their orientation is along the slip surface.

During the Pyrenean phase, strong normal faulting on the ruptures of NE-SW direction and opening of joints systems into the same direction occurred. Most of investigated precipice caves developed on these joints. It is worth to underline that they all belong to zones with well-manifested faults.

Precipices around points 10, 11, 12, and 16 are located near a morphologically well-manifested fault still not shown on official maps. All these precipices are located in brecciated zones with clear tectonic slickensides and striations on them.

During the Pyrenean phase tensile stresses varied locally from NW-SE to NE-SW direction (point 9), and the compression was oriented N-S or subvertically (uplifting of the massif). Subvertical compression lasted also during neotectonic stage when minimum stress σ_3 orientation favoured both the existence of earlier formed open cracks of NW-SE direction (points 13 and 15 — open karren and precipices; in case of point 1 — widely open karren up to several meters). Some evidence of strike-slip displacements can be seen in point 14. The controlling role of the faults for the process of massif karstification is best observed in areas of Upper Jurassic clay sandstone where caves could not exist, without the tectonic factor influence. Strong faulting and crack opening favour mechanical export of debris and typical karstic precipices formation.

Contemporary displacements are not so active but in case of NW-SE orientation of σ_1 they have led to some clear strike-slip displacements along the Dobromiri fault. Besides that, obviously the erosion rate becomes dominating over the uplifting process, and this results in sealing of many of the superficial karstic forms with deluvial materials. Thus, in spite of the high permeability for atmospheric waters into the karstic massif, precipicial type open karstic systems are conserved only within faults zones, where, nevertheless, the young tectonic displacements do not allow their fast colmatation with rock weathering materials.

The sharp-shaped relief is a result not only of tectonic displacements, but also of chemical destruction of limestones and dolomites by rains and snow. The long lasting snow cover at this altitude (between 1000 and 1500 m) is a factor for chemical erosion durability through the year. Special analyses in the region for atmospheric waters aggression potential as well as of the snow covering melting waters have not been carried out. Such an investigation would deepen the analysis of reasons for the strong superficial and underground karstic processes in Albanian Alps.

Acknowledgements. The present investigation would not be possible without the kind invitation of the Bulgarian Speleology Federation in the person of its vice-director A. Zhalov to take part in the expedition in the Republic of Albania in 1994. I was given exceptionally valuable information concerning the character of the seismic processes in the investigated region by the Director of Tirana Seismological Centre — Dr B. Muço. The field observations would be impossible without the kind help of our host — explorer Prof. G. Uruçi. I address my sincere thankfulness to all these people as well as to the Bulgarian expedition members who always helped me unselfishly during the field observations.

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Relationship between geological, tectonic, climatic and hydrogeological conditions in the karst region Boga-Kozhnia, Albania

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ABSTRACT

The expedition "Albania '96" of the Bulgarian Federation of Speleology was carried out between 20.08.96 and 05.09.96. It continued the series of Bulgarian expeditions in Albania, that started in 1992. The investigated region is situated in the north-western part of Albania, north-east of Skodra, and belongs to the western part of the Dinarides (called Albanian Alps). The area investigated during the expedition covers about 10 km^2 and is situated at 1600–1800 m altitude, north of Boga village.
The investigated area includes mainly carbonate rocks of Jurassic-Cretaceous age. From a tectonic point a view it is an uplifted block, delimited by faults striking SW-NE and NW-SE. Rocks display a high degree of tectonic fracturing. Karst is typically alpine, uncovered, with a large aeration zone.
During the expedition hydrogeological, tectonic and climatological investigations were performed. Water and rock samples were taken and analysed in the Laboratory of the Institute of the Bulgarian Academy of Science.
Preliminary conclusions are forwarded concerning the relative part of water of different origins in the karst processes. An attempt is made to provide forecasts on karst processes that occur deep in the rock massif. The main indications that need to be detected in the search for large vertical caves in the region are determined.

Key words: exokarst, karstogenetics conditions, Albania.

Relation entre les conditions géologiques, tectoniques, climatiques et hydrogéologiques dans la région karstique Boga-Kozhnia, Albanie

RÉSUMÉ

L'expédition "Albanie '96" de la Fédération Bulgare de Spéléologie a eu lieu pendant la période 20.08.1996 - 05.09.1996. C'était une des expéditions bulgares successives dont la série a commencé à partir de 1992. La région qui fait l'objet de l'investigation est située dans le Nord-Ouest de l'Albanie, au nord-est de la ville de Shkodra et se trouve ainsi dans la partie occidentale des Dinariques (connues ausi camme les Alpes Albanaises). Le terrain exploré au cours de cette expédition couvre environ 10 km² et s'étend à une altitude moyenne de 1800 m, au nord du village de Boga.
La région étudiée est composée principalement de roches carbonatées d'âge Jurassique-Crétacé. Du point de vue tectonique elle représente un bloc élevé, limité de failles d'orientation sud-ouest – nord-est. Les roches sont tectoniquement très fissurées et morcelées. Le karst est typique des montagnes, découvert, présentant une large zone d'aération.

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Pendant l'expédition on a effectué toute une série de recherches sur l'hydrogéologie, la tectonique et le climat. On a pris des échantillons d'eau et de roches qui ont été analysés au laboratoire de l'Institut de Géologie auprès de l'Académie Bulgare des Sciences.
On présente des conclusions préliminaires concernant la participation relative que les eaux d'origine différente ont dans la karstification. On a essayé d'émettre un pronostique sur le développement du karst en profondeur du massif. On a déterminé les indices les plus importants, nécessaires à la recherche des vastes grottes verticales dans la région.
Mots-clés: exokarst, conditions karstogénétiques, Albanie.

INTRODUCTION

The expedition Albania '96, organized by the Bulgarian Federation of Speleology, took place in the period August 20 – September 5, 1996. It continued the series of Bulgarian expeditions in Albania, that started in 1992. The investigated region is situated in the north-western part of Albania, north-east of Skodra and belongs to the western part of the Dinarides. Because of the short time it was impossible to cover a large area or conduct continuous observations and a study of the hydrogeological conditions in the area. For these reasons the present report will concentrate on a specific area of about 10 km^2 and the results are not conclusive in what concerns the whole Boga-Kozhnia karst massif. The results can be conclusive after an additional, more prolonged and profound study of the area.

1. DESCRIPTION OF THE INVESTIGATED REGION

1.1.SITUATION, GEOLOGICAL AND LITHOLOGICAL CHARACTERISTICS

The region where the expedition Albania '96 took place covers an area of about 8-10 km^2 bordered to the east by the chain which culminates in the peaks Maia Murigelles and Maia Livadnit. The area is surrounded to the north by steep slopes running down to the road to Kozhnia and to the west by the ridge Maia Korinotit (–1718 m elevation). To the south, the boundary consists of the steep slopes in the vicinity of the Boga village.

The average altitude of the region is 1600-1800 m above sea level, the highest peak being Maia Livadnit (2493 m). The villages of Kozhnia and Boga have the lowest altitude (about 1000 m).

In a regional perspective, the lower part of the geological section consists of consolidated detritic sediments that can be dated to the Permian-Lower Triassic period, including mainly conglomerates and sandstone which can be seen in the SE of the region. Overlying them are the carbonate deposits of the Jurassic and Lower Cretaceous periods, in the lower parts of which sandstone chalks can be seen. The region which forms the object of this specific study consists mainly of carbonate sediments. In the lower parts of the section (up to 1500–1600 m a. s. l.) gray to dark gray chalks occur, interbedded with separate, more argillaceous and gritty layers. Among them there are some layers rich in fossils, but, unfortunately, the remnants are very distorted and difficult to determine. The overlying layers consist of light-colored, almost snow-white limestone rich in bellemnites belonging to the *Duvalia* genus, characteristic of the Cretaceous period. The cone-like snails, probably belonging to the *Nerineidae* family, are common too. It is unfortunate indeed that because of the small area of the region covered by the investigations, it was difficult to establish the exact boundary between the Jurassic and the Cretaceous limestone. The thickness of the beds in the studied area varies between 0.5–2.0 m. The average dip is approximately 20° to the north and 8°–30° to the north-east.

The lower part of the region (the valleys of Kozhnia and Boga), as well as the bottoms of the Glacial circles have been filled with Quaternary glacial, prolluvial-slope debris, and, near the river banks – alluvial deposits. The area includes primarily unsorted, rounded rock fragments of various sizes with diameters ranging from 20 to 200 mm and a filling of clayey-sandstone material. Immediately above them a humus layer of 0.5 – 1.0 m maximum thickness has formed, being used for petty agricultural activities on a small scale. In terms of its geomorphology, the region has the typical appearance of the tectonic (*sensu* RODIONOV) uncovered or covered karst type. Vegetation is scarce, mainly grass and moss, while the prevailing trees are

black firs and dwarf pines at altitudes above 1800 m. The topography is rugged, the peaks are sharp, and the valleys are steep and narrow.

The negative karst landforms are abundant, about 5 – 10 m deep, and sometimes 0.5 – 1 m away from one another. Often they are almost circular in shape, with a diameter of 2–10 m and vertical walls. They usually abund in the areas where the tectonic fractures are visible at the surface. As a result of gelifraction, a considerable number of the negative forms have been filled with unsorted sharp-edged rocks ranging in size between 1–2 m.

1.2. TECTONIC CHARACTERISTIC

In terms of geology, the region is situated within the south-eastern limb of the Malezia-Madhe syncline. From the point of view of its tectonics, this is an elevated block delimited by faults striking SW-NE and NW-SE, parallel to the major tectonic elements of the region, i.e. the large Petroshan-Velecikut-Kozhnia fault, the Dobromires fault bunch and the Boga-Budachi fault (Fig. 1).

The results of similar structural-geological and tectonic investigations conducted during the Albania'94 expedition were published in a report (SHANOV, 1996). It indicates that some fractured structures have been noticed which run approximately in a N-S direction in the region of Camp 1 and SW-NE and SW-SE in the region of Camp 2. The general direction of these fractured structures coincides or it is perpendicular to the general direction of the Velecikut-Kozhnia fracture and the Dobromires fracture. The systematically measured cracks in the area of Camp 2 are primarily sub-vertical (80°-90° dip) striking prevalently N-S and NE-SW.

1.3. CLIMATIC, HYDROGEOLOGICAL AND HYDROLOGICAL CONDITIONS FOR KARST DEVELOPMENT

The clearly visible tectonic fractures in the studied karst massif, the considerable elevation of the blocks, the cracks in the rocks and the absence of rich vegetation, provide a straightforward opportunity for fast rainfall infiltration, as illustrated by the hydrogeological map of the region, which indicates a coefficient of effective infiltration of 0.6 – 0.7.

The climatic conditions in the region and the high altitude imply an increased amount of snowfall, taking into consideration that the period of active precipitation is September–April (Fig.2) and that the average annual precipitation is 2 000 mm/m^2.

The period of active snow-melting starts in May and the melting itself is intense because of the bare, sun-lit slopes. It is exactly during this period that the karstification of the rocks is the most active. Besides, there are certain conditions that make the chemical corrosion of the rocks much less significant than the physical-mechanical impact of the water, because of

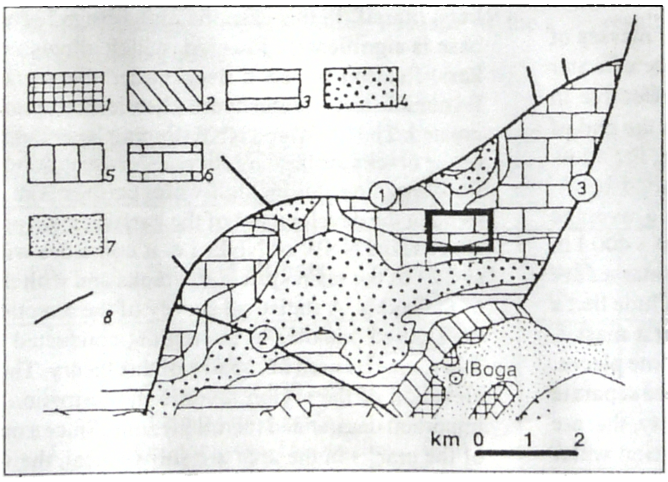

Fig.1. Geological and tectonic scheme, based on the geological map of Albania (by SHANOV, 1994)
1. T_3-limestones and dolomites; 2. J_1-limestones and dolomites; 3. J_{2-3}-not divided limestones and dolomites; 4. J_3-limestones and clayey - sandstones; 5. J_3^1-limestones; 6. K_1-limestones, conglomerates, clayey - sandstones; 7. Q-quaternary sediments;
8. Faults: 1. Petroshan-Velecikut-Kozhnia; 2. Dobromires fault bunch; 3. Boga-Budachi.

Schéma géologique et tectonique de la région explorée, élaborée d'après la carte géologique de l'Albanie (après SHANOV, 1994)
1. T_3-calcaires et dolomies; 2. J_1-calcaires et dolomies; 3. J_{2-3}-calcaires et dolomies indifférenciés; 4. J_3-calcaires et grès argileux; 5. J_3^1-calcaires; 6. K_1-calcaires, conglomérats, grès argileux; 7. Q-sédiments quaternaires;
8. Failles: 1. Petroshan-Velecikut-Kozhnia; 2. faisceau de failles des Dobromires; 3. Boga-Budachi.

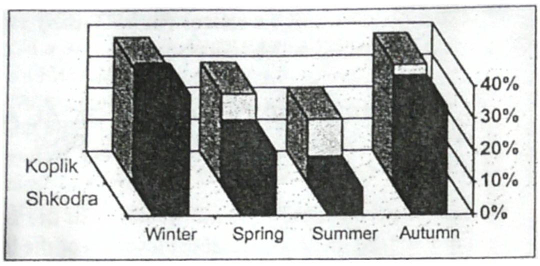

Fig. 2. The percentage of the annual precipitation measured in Skodra and Koplik meteorological stations.
Pourcentages des quantités annuelles des précipitations mesurées dans les stations météorologiques de Shkodra et Koplik.

its high velocity and its comparatively short period of activity. Most probably, the erosional processes prevail to a large extent over the corrosional ones, a fact which was established when the geological map of Albania was being prepared.

The comparatively low and constant temperatures – ranging between 2° and 6 °C (STOEV, 1996) in the potholes and the caves at this altitude induce the occurrence of condensation waters down to a depth of 20 m, i.e. where climatic conditions in the cavities remain relatively stable. The condensation water flow in some caves, seldom reaches the value of 0.180 l/sec (The Vertical Cave K20). The investigation has shown that the average water flow is approximately 2 ml/h.

Because of the climatic conditions snow and ice are preserved at the bottom of some vertical caves (over 10 m deep) throughout the whole year. Research performed on some of the accumulated layers showed them to be over 400 years old.

During the hot dry summer months these masses of melting snow serve as an additional source of water for the karst massif and are probably effective in continuing the karstification process. At the end of August, when the expedition took place, the snow areas at the bottom of some shafts studied by A. Stoev induced, as a result of their melting, average water flows of 0.003 – 0.004 l/sec or 300 – 400 l in 24 hours. Considering the fact that snow masses are not uncommon in the region, we can conclude that a large amount of water flows into the karst massif, even during the dry summer months. In some places, especially on the northern slopes, there are separate perennial springs with low yielding capacity, that are probably supplied by the very condensation water and by snow melting. In the lower parts, filled with slope debris-prolluvial and glacial deposits, there are shallow ground water bodies, the free surface of which sometimes reaches up to the ground level and in some cases causes the formation of shallow lakes (lake Boges).

This fact enables local population to build artificial reservoirs functioning all year round, by shallow digging into the ground. These reservoirs are used for irrigation and as watering places for cattle. They are probably refilled on account of rainfall, condensation or melting of the snow masses in the area.

1.4. KARST PROCESS AND THE HYDROGEOLOGICAL ZONES IN THE MASSIF

The local erosional bases in the region under study are the ravines formed by the local superficial fractures. Considering the problem on a larger scale, one could infer that groundwater and the inflow to the surface waters succeed to reach the major tectonic fractures, i.e. the Velecikut-Kozhnia fracture to the north, the Dobromires fracture to the south and south-east, and the Boga-Budachi fracture to the east and south-east. These tectonic structures are clearly marked at the surface, and likewise are the big valleys along which temporary rivers flow during high-water periods. Their beds serve then as drainage pathways for discharging to the main drainage area – the Skodra Lake, where the largest karst lakes are to be found – the surface and underground water originating in the karst massifs above. During the dry months however, when rainfall is limited and the groundwater level drops, the dry streambeds rather serve as zones feeding the karst massif. In this case the underground erosional base is significantly lowered, which allows vertical karstification to reach deep under the surface, if favourable tectonic and hydro-chemical conditions are created. The NNW and NNE dipping layers and most of the cracks strikes largely control the groundwater flow direction during high-water periods. The major trend in the development of the karstification process also strikes NNW or NNE, i.e. it coincides with the strikes of the main system of cracks and with the dip of the layers. A statistical survey of the directions of the studied potholes in the region, conducted by A. Jalov, may be used in support of this theory. The high elevation of the region favours the formation of an important unsaturated (aeration) zone. Since a number of the cracks in the area are sub-vertical, the water-

flow velocity is high and drainage is comparatively fast, which, as has already been mentioned, does not create favourable conditions for good chemical karstification. This can be seen in the morphology of the precipice caves, which appear to be wide cracks rather than well-shaped shafts and galleries, especially near the local fractures developed in deeply dissected zones. In the massif areas that are more distant with respect to the fractures, where the rocks are not so crushed, other conditions being similar, larger voids are more likely to be formed. The water streams may not 'disperse' along the network of cracks, but may concentrate on one crack or a system of cracks and enlarge it. The zone of seasonal circulation, formed beneath the aeration zone, is probably considerable in size. This assumption is based on the findings of the previous expeditions, namely that during the summer period the beds of the rivers flowing along the above mentioned valleys are dry, i.e. the water level is very low. During the heavy rainfall and the snow melting periods enormous quantities of water penetrate into the massif, a process which significantly raises the groundwater level, while the rivers become swift flowing. In the seasonal circulation zone karstification is probably more active as there are conditions for increased aggressiveness with respect to the calcium carbonate when waters flowing into the aeration zone mix with those from the water saturation zone.

The water saturation zone probably starts at a considerable depth under the river beds, where the underground river levels drop during the dry periods, and reaches the levels of the karst springs in Skodra Lake. This means that there may be an important, about 1000 m thick, saturated water zone, where karstification is slowly deepening, but where probably enormous volumes are circulating because of the enormous water quantities.

2. LABORATORY WORKS

2.1. ANALYSES OF THE ROCK SAMPLES

Samples were taken from surface limestone at various altitudes in order to establish the relationship between the composition of carbonate rocks in the region and the karstification conditions. The samples were subjected to carbonate analysis at the Geo-chemical Laboratory of the Bulgarian Academy of Sciences and the results are indicated in Table 1.

The table reveals that there are virtually no differences in the composition of the rocks within this altitude range. Because of this we may assume that karstification may be a even process down to these depths, provided that the tectonics of the massif and the chemical composition of the waters do not interfere.

2.2. ANALYSES OF THE WATER SAMPLES

Our main goal in examining the water samples was to establish the aggressiveness with respect to carbonate of the waters flowing through the region. By establishing the quantities of aggressive CO_2 it is possible to determine the water ability of dissolving the carbonate rocks which form its reservoir. For this purpose samples were taken by tracking the inferred water flow upwards and downwards, i.e. rain and snow, water from K 21 cave (altitude 1880 m) and water from the well near the camp below Drugomires peak. The basic physical parameters of the water were measured on the spot and the free aggressive carbon dioxide content was established by measuring the acid neutralizing capacity up to pH 4.4 (K_t 4.4) and the basic neutralizing capacity to pH 8.3 (K_o 8.3). The results are given in Table 2.

The parameters studied on the spot are practically permanent for the respective type of water, especially

Table 1. Carbonate analysis
Analyse de carbonate abrégée

N	Site and altitude	Insoluble residuum (%)	Fe_2O_3 (%)	CaO (%)	MgO (%)	CO_2 (%)	Sum (%)	FeO (%)
1.	Camp 2 by cave K21 (1850 m)	0.52	0.20	54.00	1.29	43.91	99.92	0.18
2.	Camp 1 (~1600 m)	0.40	0.10	54.00	1.29	43.85	99.64	0.09
3.	Camp under peak Drugomires ~1500m	0.40	0.10	54.73	0.78	43.86	99.87	0.09

Table 2. Main chemical indices of the waters in the region.
Principales caractéristiques chimiques des eaux de la région.

Type of water	Site and altitude	T°C	pH	Conductance æ mSi/cm	Ionic strength μ mmol/dm³	Total minerali-sation mg/dm³	HCO_3^- mg/dm³	Free CO_2 mg/dm³	Aggressive CO_2 mg/dm³	Equi-poise pH	Index of saturation I_s
Rain	Camp2 ~1850 m	18.2	6.6	145	2.773	157.13	-	-	-	8.13	-1.53
Hail	Camp2 ~1850 m	-2.2	6.8	77	1.618	91.69	73.20	4.09	3.50	8.17	-1.37
Snow	Camp2 ~1850 m	-2.1	6.9	36	0.756	42.88	21.35	4.84	4.80	8.18	-1.28
Conden-sation	Cave 21 1826 m	4.2	7.3	130	2.746	155.62	143.35	11.75	6.70	8.17	-0.87
Spring	Spring ~1550m	7.8	7.6	168	4.202	238.14	-	-	-	8.39	-0.79

in dry periods, when there is no active mixing. That is why they can be used in order to obtain a relatively precise estimate of the characteristics of the aggressiveness of the water at a specific moment or period. As can be seen from the Table, all studied water samples contain aggressive CO_2, i.e. they may have a dissolving effect on the carbonate rocks that they encounter.

The above stated facts, as well as the data about the waters flowing into the massif, contribute devis a probable evaluation on the influence of the waters of various origins on the karstification. The waters are divided into three types:

PRECIPITATION WATERS (rain, snow, hailstorm)

They are undoubtedly the most effective in the process of karstification, considering the large quantities of water that flow into the massif during the rainy periods and the periods of active snow melting. They are characterized by increased aggressiveness, probably increased by the weak acids they contain as a result of the global industrial pollution of the atmosphere.

WATERS FROM THE MELTING OF OLD SNOW AT THE BOTTOM OF NEGATIVE LANDFORMS

They are strongly saturated with aggressive CO_2. They are most active during the hot summer months, when melting is the most intensive.

CONDENSATION WATERS

The high content of aggressive free CO_2 could be ascribed to their secondary saturation with carbon dioxide originating in in the dissolution of the calcium carbonate. These waters react most actively with the rocks during periods of increased humidity and relatively high temperatures – in spring and early autumn, and less actively during the summer months when humidity in the atmosphere is lower. They contribute mainly to shaping the morphology of the caves and potholes. The relative contribution to the rocks karstification of water having a specific origin is shown in Fig. 3.

CONCLUSIONS

The research which has been carried out and the data that are currently available are insufficient for a complete description of the hydrogeological framework of the region. The compiled data may be used as a basis of further studies. The conclusions we can draw from the research are primarily of practical importance for speleological studies of the area.

1. The lithological and tectonic setting of the massif creates favourable conditions for the formation of gigantic karst systems with an elevation range of over 2000 m between the zones of supply and drainage.
2. The strong tectonic activities create prerequisites for the occurrence of large cavities, especially in the lower parts of the aeration zone, near the local

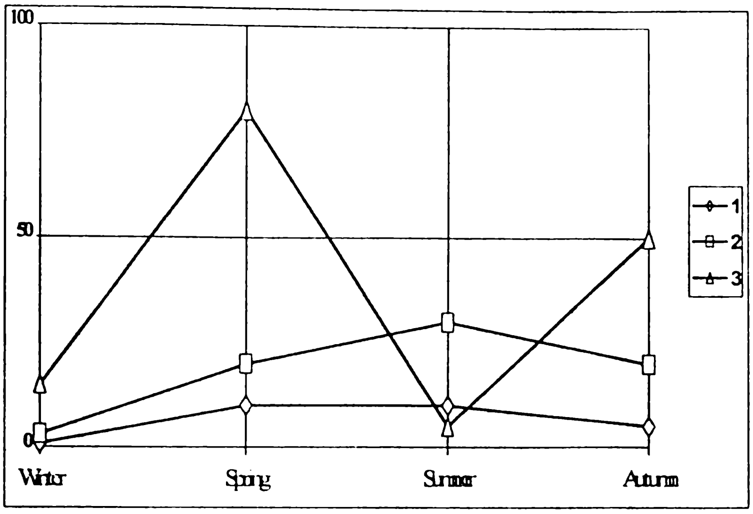

Fig. 3. The relative contribution in the rocks karstification, as a function of season, of water having a specific origin
1- Condensation water; 2- Water derived from melting of old snow accumulated on the bottom of negative landforms; 3- Rainfall water.
Part relative des eaux d'origine différente dans la karstification pendant les différentes saisons
1- Eau de condensation; 2 - Eau de fonte des neiges anciennes acumulées au fond des formes négatives; 3-Eau des précipitations.

tectonic fractures. The marked tectonic dissection implies the division of the stream into a multitude of trickles, its fast drainage and as a consequence, insufficient time for corrosion activity. Unfortunately, this also means that below certain depths the cavities will be too narrow for people to get through. Practical experience has shown this to occur 600 – 700 m below the surface.

3. Larger voids may exist in the area of seasonal variations as well as in the area of full water saturation because of the water volumes circulating there.

4. The intense gelifraction induced by the large temperature fluctuations, together with the considerable tectonic dissection, causes the destruction of the entrance areas and the clogging of the vertical sections, which makes penetration into the caves either difficult or impossible.

5. From a speleological point of view and based on the results of the present investigation, we can outline the following approximate profile, specific for the studied region, of a probably existing big (over 200 m) vertical cave:

- entrance situated above 1800 m altitude and at least 500 m away from the local fracture zone, i.e. development in more solid and less cracked layers;
- entrance vertical section – at least 20 m and a large diameter, located on a north-facing slope and with snow at the bottom, indicative of possible active karstification throughout the whole year;
- development of sub-vertical major cracks, striking almost parallel to the general dip of the layers, i.e. the most favourable directions are N-NW or N-NE.

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КАРСТОВИ ФЕНОМЕНИ И ОПАЗВАНЕ

АБЛАЦИЯ НА МЕТЕОРИТИ В КАРСТОВА СРЕДА

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Анализирани са данните от изследванията на метеоритни частици, открити в карстов масив в Албанските Алпи, намиращ се северозападно от с. Бога, Албания. Масивът е образуван в юрски и триаски варовици и е деформиран в края на еоцена. Метеоритните частици са получени вследствие на аблацията и палеометеоритния удар. Утаяването на множество индивидуални екземпляри, отделени от основното метеоритно тяло (в юрското море) е лимитирало по-късно тяхната позиция в обема на окарстяващия се масив. Като най-вероятен механизъм на аблация е предложено разпръскването (spraying) на метеоритното вещество вследствие на втечняване на повърхностния метеоритен слой. Раздробяването е под формата на сферични и колбички с характерни морфометрични размери 10^2 - 10^{-1} см (и намерените екземпляри са с размери от 10 см до няколко милиметра).

Разгледана е вторичната аблация на метеоритните частици. Моделиран е процесът на образуване на карстови колектори вследствие на водно-механично отлагане на метеоритно вещество в процеса на карстифициране на масива. Коментиран е гранулометричният състав на съдържанието на карстовите колектори и разположението на метеоритните частици в тях. Оценена е скоростта на водния поток (транспортирал и отложил механичните частици). Тя е в интервала 0,8 - 5,5 м/сек и прогресивно намалява във времето.

Направен е спектрален анализ на три метеоритни къса. Оценени са: основният химичен състав - Fe (91%), Ni (8,4%) и Co (0,5%), както и класът на падналия палеометеорит - желязно-никелов. Коментирана е морфометричната еволюция вследствие на механичното оглаждане на частиците.

В заключение е обсъдена ролята на откриваните в хода на експедиционните наблюдения палеометеоритни колектори в изучаването на спелеогенезиса и спелеолитогенезиса на отделните карстови райони в света.

METEORITE ABLATION IN KARST MEDIUM (in press)

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Data from the investigations of meteorite particles found in a karst massive placed north-west of the village of Boga, in the Albanian Alps, Albania has been analysed. The massive is formed in the Jura and in the Trias limestone and is deformed in the end of the Eocene. Meteorite particles are derived as a result of ablation and paleometeorite collision. It was precipitated many individual representatives separated from the basic meteorite (in the Jura sea). That is the reason of their limited number in the volume of becoming karst massive. As a most probable mechanism of ablation is proposed the spraying of meteorite substance as a result of liquefying the surface meteorite layer. The breaking to pieces is under the form of spheres and flaskets with characteristic morphometric dimensions of 10^2 - 10^{-1} cm (the representatives found are with dimensions of 10 cm to several mm).

The secondary meteorite particles ablation is considered and the process of karst collectors formation after water - mechanical precipitation of meteorite substance in the process of massive becoming karst. The granulometric content of karst collectors and meteorite particles' disposition there are commented. The velocity of water flow transported and precipitated mechanical particles has been estimated. It is in the interval of 0.8 - 5.5 m/s and progressively decreases in time.

Chemical analysis of six meteorite pieces has been made. It has been estimated the basic chemical composition Fe (91%), Ni (8.4%) and Co (0.5%) as well as the class of the fallen paleometeorite - ferrous - nickel. The morphometric evolution after mechanical smoothing of particles is commented.

Temperature Anomalies Formation and Secular Instability Research of Ice of Atmospheric Origin in the Karst Caves of North Albanian Alps

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Abstract

The negative temperature anomalies in the karst caves of North Albanian Alps are a widespread phenomenon. The anomalies represent a decrease of the average anomalous temperature of the air and the main rock, in the cave entrances, in comparison with caves' deeper parts, in the presence of a lot of ice there.

The difference in air exchange between caves with a different morphology and altitude is examined in the paper. An analysis of the temperature regime of thirty-eight caves has been made. The interaction between ice formations and karst massif geothermal field is shown. Three types of caves has been determined:

1)warm caves with cold entrances and steady ice accumulations;

2)completely warm caves;

3)cold caves with significant seasonal changes of the air flow in their entrances.

The influence of snowfalls' quantitative balance on caves' temperature regime is investigated. The combination of three heat bearers: ground atmospheric air, the karst massif and the falling water on it and within it forms a relatively stable temperature, providing constant seasonal course of the temperature in the caves.

It is shown that the microclimatic regime in caves, as a whole, is not determined by their origin, but depends on two factors: the angle of 'e negative bias of the caves, from the entrance to the bottom (depth of the karst massif) and the surface of the entrance aperture cross-cut-section. It has been found that the accumulation of cold increases with the increasing of the two factors. If the negative slope has a greater angle, and the entrance opening is comparatively small the cave is classified as "cold ".

More than 40% from the investigated caves are glacial. The ice accumulates in the spring, when a big part of the incoming waters freezes over the supercooled walls of the karst massif. Another way of prolonged ice supply forming is due to the infiltration humidity, carried up from the bottom to the cave surface, during the winter - spring period.

The negative temperature anomalies' formation in the karst caves of North Albanian Alps is determined by their peculiarities as physico-geographical objects. They are interesting to study due to their situation in the caves and in the karst massif, availability to express contrasts in the microclimate of the whole cave, and due to original processes of atmospheric circulation inside and outside the caves combined with the specificity of hydrological processes (HOTI MAHIR, 1990).

Temperature anomalies could be defined as a result of microclimatic processes in the caves that cause a decrease of the mean annual temperature of the air and the main rock, in the cave entrances, in comparison with caves' deeper parts. Most of the caves in this region of the Albanian Alps are cold during the whole year because of the constant mean day-time temperature in the interval of -1÷4°C, as well as of the existence of great amount of ice, firn and snow in the entrance cliffs and halls. The basic factors that influence such temperature anomalies' formation are:

1. Caves' morphology.
2. Peculiarities of the local relief.
3. Temperature regime of the underground waters.
4. Their thermal regime which depends on the character and intensity of the air exchange.

The caves are grouped in a zone placed north-west of Shçoder, in the region of the high-mountain village of Drugomiri, at 800 to 2000m altitude. The mean annual air temperature is in the region of 8 to 12°C and the mean annual rainfall is in the interval of 1600 to 3000mm. The rainfall minimum occurs during the summer and the depth of the maximum seasonal freezing is nearly 120cm. The climate is subtropical and Mediterranean and it is cool and damp in the mountainous massif covered with limestone (STOEV, 1996).

The karst massif temperature is in the dynamic interval from 2.6 to 7.8°C in the shade during the summer (SAVELEV, 1985). The rock temperature in the stratum is a constant temperature of 2.6°C, and its temperature in the first level carrying water is 2.2°C. A field work on defining basic microclimatic elements' regime and the cave typology has been done as follows:

- depending on the snow-ice stock;
- depending on the temperature of zones with constant temperature (ZCT);
- determining of speleoatmosphere humidity;
- determining of the dynamics of the air exchange;
- determining of the dynamics of the water flowing from the glacier or the snowdrift.

Applying classical methods of microclimate investigation in the caves from the region, data for the basic microclimatic parameters have been obtained. Comparatively low air temperatures in the interval of -0.8 to +4.4°C have been registered. These temperatures as well as the availability of snow and ice mass of many years determine the examined caves as ice-caves. The zone of thermostatic air begins from the place of the first snow accumulation which imbalances the microclimate of the caves and they become colder than the others at the same sea level and climatic zone (SHVETSOV & KOVALKOV, 1986). In ZCT the relative humidity is 60 to 80% and in most of the caves the flowing and dropping water is too little. Shift-flowing draughts with high velocities are not typical of the air exchange in caves. The standard equalization of both cave barometric pressure and that one of the outside ground air layer creates weak draughts outside and inside without anomalies of the velocity or their direction. Taking into account that the caves in the region are developed mainly in zones of vertical-going down, passing and horizontal circulation of the underground waters, it is natural to associate part of the air exchange with karst massif clefts connected with the surface. Velocities of the order of 0.005 to 0.020m/s were registered. The air quantity coming in the caves from the plateau is $30m^3/h$ for isostatic caves and 20 to $25m^3/h$ for dynamic ones.

The analysis of the collected material connected with microclimatic studying permits making of following conclusions:

1. Formation of karst, caves and cave systems contributes to accumulation of cold air masses. This determines the caves investigated as cold and some of them as icy caves.
2. Only the following basic conditions are completed the cold generation. Ice formation and its long period preserving in the caves from the region are possible because of:
   a) considerable height difference of the local relief forms;
   b) bag form of the karst systems or siphon available;
   c) good cleft net with guaranteed opening on the surface;
   d) the bottom of the cave is screened by alluvial material -clay and rubble.
3. The sharp temperature boundary between cold and warm air masses which is on the way of infiltration waters contribute to detaining and piling up incoming water in hard state.
4. Preserving ice during summer is favoured by the northern slope, the slow melting of the large volume snow stoppers and cold air standstill in the clefts and negative relief forms.
5. The diurnal temperature amplitude becomes quiet at a depth of 35 to 36m from the surface.
6. Ice formations are localized at the cave entrances and on the walls and bottoms of the large vertical caves.
7. The cave ice is polygenetic. At the entrances the ice tongues, firn cones and gaskets are mainly of atmospheric origin and are formed after making tight snow masses entering from the surface. In the inner parts icy stalactites, stalagmites, columns, and icy "armours" have mainly hydrogen origin due to both infiltration of atmospheric rainfalls through the cleft net of the karst massif and freezing of the condensation water.
8. The snow, firn and ice accumulation are favoured by the large initial precipices (>20m). The age of blocks of snow and ice could be estimated using measurements about their annual layers (SHUMSKI, 1955). In a section of a block from K25 cave nearly 356 layers has been registered. For K25A cave they are 286. Probably this stratification shows limited age of the blocks - about 400 years.
9. The optimal water flow supplying levels carrying water is formed from the melting ice and the process of condensation in cave volume.

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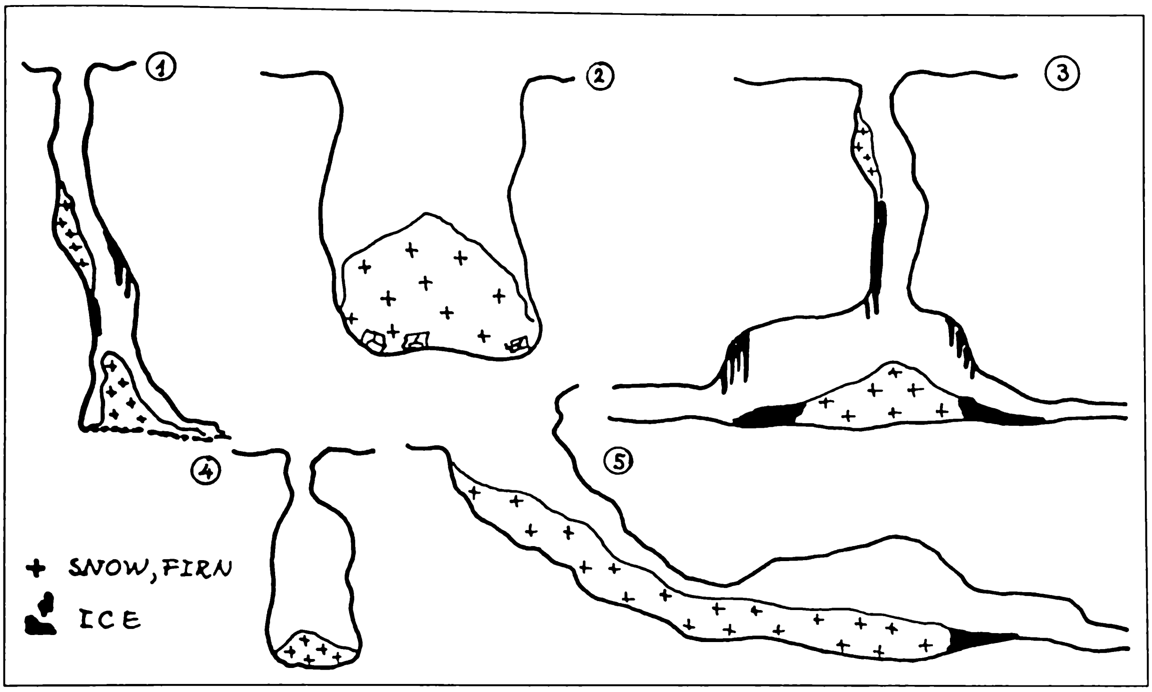

Figure 1 : Morphological typologies of snow-ice accumulations.

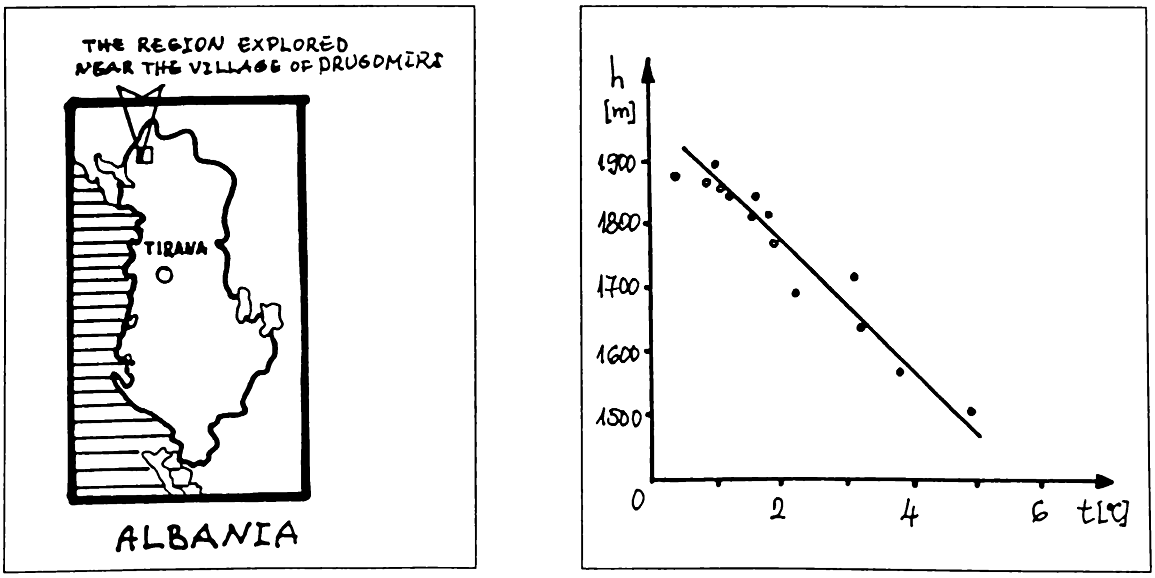

Figure 2 : Air temperature in the zone of constant temperatures depending on the altitude of the entrances.

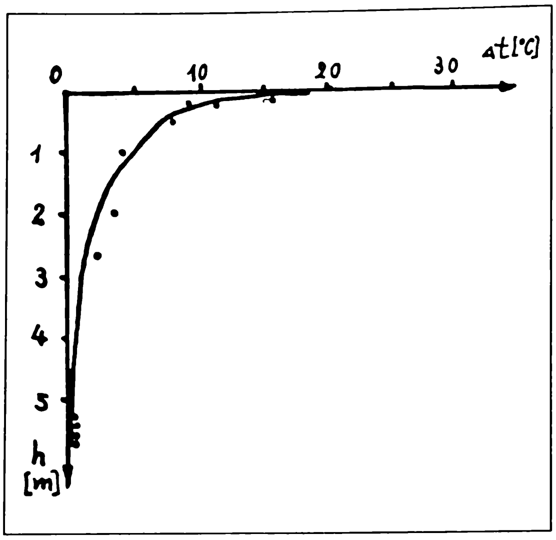

Figure 3 : Diurnal temperature oscilations amplitude in depth.

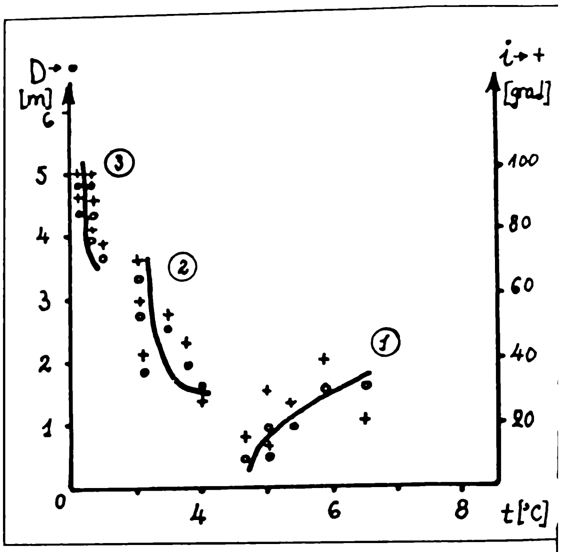

Figure 4 : Cave distribution diagram - 1-warm, 2-cool, 3-icy, depending on the entrance diameter - d, and the inclination - i.

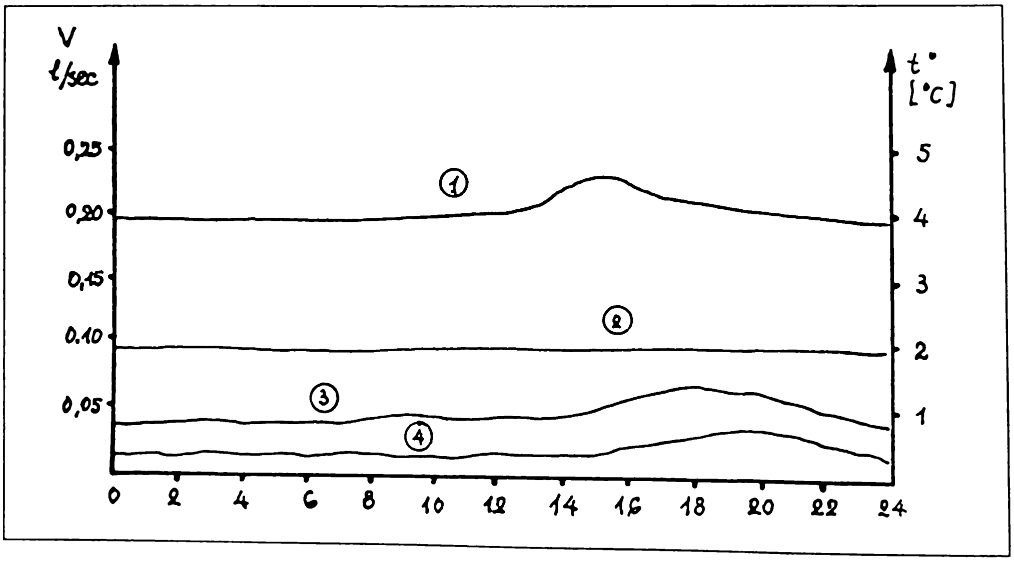

Figure 5 : Maximal amplitude differences of the water stock from the snow block 3 and dropping form 4 and the air temperature in the speleoatmosphere.

Results from Bulgarian-Albanian Speleological researches in Albanian Alps from 1991-1996

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Abstract

The present work contains the data, most of who unpublished, collected during the 8 th Bulgarian-Albanian speleological expeditions carried out in the Albanian Alps from 1991 to 1996.Albanian Alps is located in the North part of Albania and is the greatest mountain in Albania covering an area of 2010 sq./km. The explored area is located in Southern and Central part of the Mt.and covered an area of approx.320 sq./km made up by Jurassic and Triassic limestones. The direction of main folds is NE-SW and NW-SE. Faults play a control role about atmospheric waters drainage as well as about machanical transportaion of debris and deep up to several hundred meter pricipies open around them mainly in brecciated zones.

One hundred ninety eigth new caves were discovered and surveyed.The most important vertical caves are:BB-30 at altitude 1940 m a.s.l. (-570 m); Shpella Cilicokave at 1840 m a.s.l (-505 m) and B33 (-205 m) and 13 other caves deeper than 100 m. The most important horizontal cave is Shpella e Majes te Arapit at 1000 m a.s.l - total length 840 m .The largest cave shamber is that of Shpella e Gjolave vith an area of 8875 sq. m and volume 443 750 cub.m. The deepest and longest of karst spring who were dived is Siri i Sheganit (160m,lond and deep -52 m).

The analysis of micro-climatical studies in 12 caves with tipical climate pointed the temperature of 4 °C, relative humidity 48-99% and dynamic of cave atmosphere in range 0.005 - 0.020 m/sec.

1. General data of Albanian Alps

North Albanian Alps is a part of Dinaric Mountains. It is the largest Mt in Albania covering on area of 2010 sq.km (TALANI, 1990).This vast area due to its geographical position and its climatic as well geological conditions constitutes a tipical karst region in Europe.

The climate is humid with annual precipitation of 2000-2800 mm concentrated during the period October-May.The annual average temperature is 10.2° C.

The Alps is built of folded and fissured Mesozoic and Paleolgene limestones with max.elevation of 2694 m. a.s.l. at peak Ezerca. Dislocations with domminant directions NE -SW and NW-SE divide the Mt. in a lot of single foult blocks. The mean coeficient of effecient infiltration is karst is about 0.6 - 0.7 (Hyd.Geol.Map, 1981).The acqufer is draned by many karst springs mostly of which situated at the foot of mountain. The largest of them is Siri i Sheganit near Shkodras Lake with max. capacity 6.9 m^3/sec. in May and min. 0.300 m^3/sec. in August (HOTI,1990).

Geographical and geological terms determinate the theoretical vartiacal range of more than 1000 m .

2. Former studies of karst and speleology

Scientific research of surface karst phenomena may be attributed to lbaniangeographers (KRISTO,1973), (GRUDA,1981,1985,1990), (HOTI,1990) etc. The first archaelogical & paleontological study of Albanians Alp cavpella Gajtanit) date from 1923 . The same cave were escavated by A.Fistany in 1961 and 1982 where the fossil remains of Hominoids were found.(FISTANI,1982).

Numerous underground cavities has been destributed from the pioneers of Albanian speleology Z. Ubani,M.Uruci, G.Uruci, K.Gjilbegu,A.Codra,H.Hasa etc.(URUCI,1994)

The beggnning of biospeleological studies date from 1914 when C.Lona from Triest collect the first Coleoptera from the caves of Mt Cukali. Some other caves were explored biospeleologicaly from A.Bischoff,C.Lona and A.Winkler in the period 1922-1931 (GENEST & JUBERTHIE ,1994) Czech speleologist Hanak (HANAK,1964) and Italian (LATELLA,1994).

In recent years starting from 1989 many foreign speleological expeditions have been carried out in Albanian Alps. The Italian expeditions in 1989,1993,1994,1995 and 1996 ; Italian-San Marinian from 1992, 1993 and 1994 and Belgian in 1992 made detailed and sistematic investigation on mountain and brought to information about numerous new caves amongst whish: Shpella e Pusit depth -370 m and long 5 km - the longest cave in Albania; Shpella Uomini umidi-depth 520 m - second deepest in Albania and Shpella e Gjek Markut - 234 m deep.

The results abtaned was seen genetally in the following : (GARBELLI,1993),(MANCINI,1994),(FERRARI,1994), (GAMBARI&LATELLA,1994) and (UYTTERHAEGEN,1993).

3. Setting of explored area

The area is located in the SW part of Albanian Alps between 42° 16' 30" and 42° 28' 30" of latitude N and 12° 23' 00" and 19° 46' 45" of longitude E. It occupies an area of approximately 320 sq.km with the following borders: from N-NW the canyon of Semi river to Tamarja vill. and then the riverside of Semi e Vuklit river to Nikci village; from S-SE the stone road from Koplik to Theth vill.;from E the axe from Theth to Nikc villages and from W the coast of Shkodras Lake from Koplik to Kastrat vill.

From orographical point of view this region comparise some well grounded internal massifs jointed transversally and lengthwisly on different hypsometric levels. The main massifs looking from W to E are: Velechik (1726 m a.s.l), Pultines (1804), Dragomires(1904), Murigelles (2191), Bridashes (2125), Livadhit (2493), Radohines (2567) and Arapit (2217 m a.s.l) (figure 1)

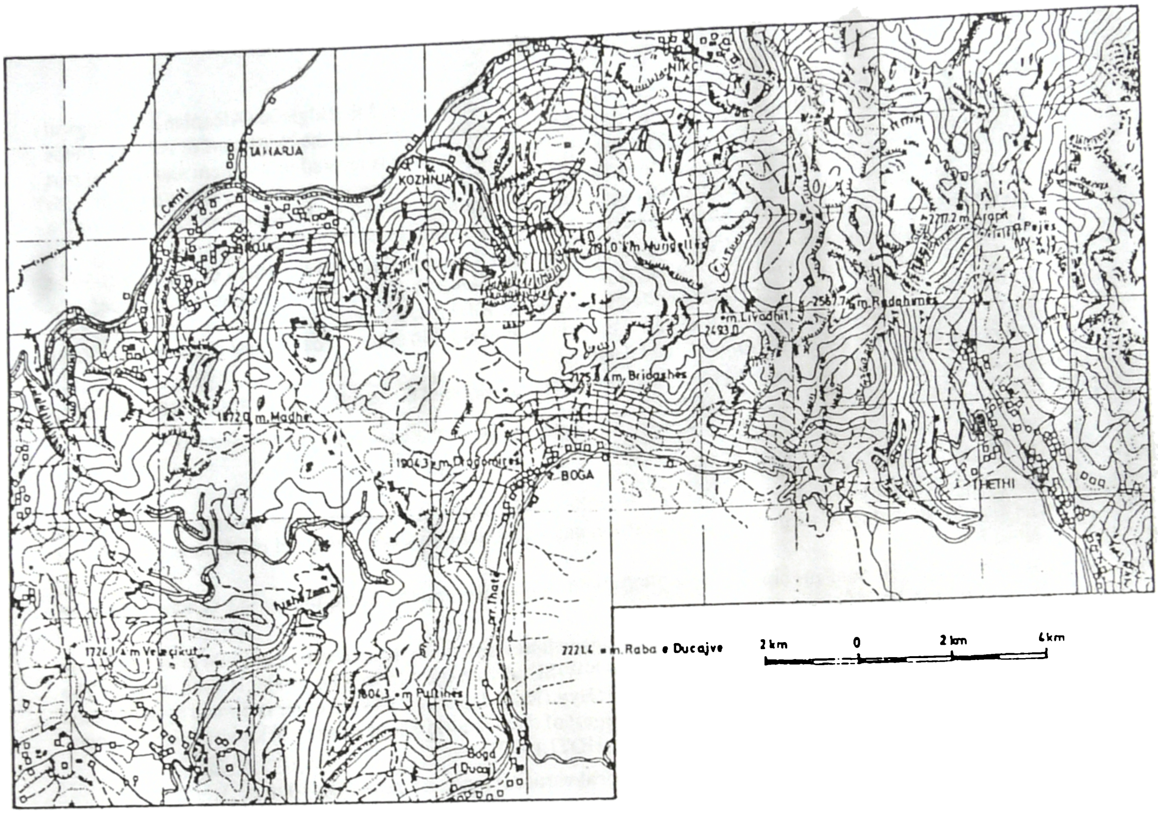

Figure 1 : Albanian Alps - main part of explored area

4. History of Bulgarian-Albanian speleological explorations

The first recognize expedition were carried out in november 1991. The first 5 caves were explored by A.Jalov, N.Gladnishki & N.Landjev supported by G.Uruci, M.Quku and K.Gjylbegu. The most impressive cave were Shpella Gjolave.

From 24th July to 21 st August 1992 Bulgarian Federation of Speleology and the Albanian Speleological Association held second joint expedition. The object of expedition was the west part of Albanian Alps and especially the massifs Velechik, Pultina, Maja Zez and Arapit. Over 100 caves were discovered, of which only 52 were explored. The most interesting exploration took place in Shegan karst spring, which was explored to a length of 60 m and depth of -28 m.

From May 19 and June 11, 1993 the third expedition were held. The main exploration area were located in Bridash massif. Thirty eight mainly vertical caves were explored. The deepest of them were Shpella e Cilikokave which were explored to 390 m. The team went to Shpella Majes Arapit to continue exploration from 1992.The cave diving of terminal sump(length 90 m) and some new discoveries gives total length of 840 m.A second attempt was made to Shegan karst spring so the explored length grow to 160 m at depth 52 m. The sump continues but further exploration requires mixed gas. The expedition put the beginnings of systematical geological and bio-speleological studies on area.

In September 1993 the 4 th expedition concluded with a depth record of 505 m This was the deeepest point of Shpella Cilikokave (figure 2), discovered end explored to 390 m during the previous expedition in May.

In June 1994 a group of 8 persons made a fifth bulgarian expedition.Its object were the exploration of the Dragomiri massif. Twenty four vertical caves were explored. The deepest of them BB-1 (Ice Cave) with depth 162 m. During the expedition some geological and tectonic trips were made along with bio-speleological and speleo-climathological studies.

In September of the same year the speleo club "Studenetz" Pleven went to Bridash to continued the work of cave BB-30 discovered and explored to the limit 60 m in 1992.The cave were explored to 260 m dep. without reaching the end.

In june 1995 a team of 9 bulgarians supported by G.Uruci work on the caves of Korinotit and Muriqelles massifs.There were discovered and surveyed 28 new caves the deepest of which V-21 with 110 m. Some caves were explored bio-speleologicaly.

From 8 to 24 September 1995 the cavers from SC"Studenez"-Pleven worked again in BB-30. The superb efforts resulted in discovery of few undescended pitches to the depth 570 m without end- new depth record in Albania and 26 new caves.

The last bulgarian expedition were held in August 1996 when there were discovered and explored 26 new caves on surroundings of massifs Korinotit,Muriqelles, Drugomires and Bridash.The deepest of them were K14-148 m; Vb11 -112 m and K21-110 m. During the expedition hydrogeological, lythological, speleo-climathological and bio-speleological studies were made.

5.Results

The eight expedition resulted in discovery and exploration of 198 new caves in Albanian Alps.Most of them are vertical, who can to be divided in vertical ranges like follows: deeper than 100 m - 17 caves (table 1); from 80 to 90 m - 9; 70-80 m-7; 60-70 m- 4;50-60 m-12 and 147 caves in the range from 10 to 50 m deep.

The longest caves is:Shpella Majes te Arapit - 840 m and dinevelation + 58 m , Shpella Jubanit - 255 m and K20-205 m.

The largest cave shamber is that of Shpella e Gjolave with an area of 8875 sq. m and volume 443 750 cub.m.

The deepest and longest of the third karst springs who were explored is Siri i Sheganit respectively - 52 and 165 m.

The devision of 126 th of all explored caves on hypsometric levels is like follows: 300-400 m a.s.l. - 2 caves; 500-600 - 2 caves; 1000-1100 -1; 1400-1500 -13; 1500-1600-21; 1600-1700-16; 1700-1800-19;1800-1900-41 ;1900-2000-11.

No	NAME	ALT. M A.S.L.	DEPT	LENGT	YEA
1	BB-30	1940	570	-	1995
2	Shpella e Gjolajve	1840	505	246	1993
3	B-33	1880	205	165	1993
4	BB-1	1460	162	-	1994
5	K-14	1630	148	-	1996
6	B-24	1870	135		1993
7	VB-50	1550	131	-	1992
8	V-11	1610	112	-	1996
9	Shpella Majes Zeze	1520	110	-	1992
10	V-21	1563	110	-	1995
11	K-21	1830	110	100	1996
12	Shpella Jubanit	410	110	225	1991
13	Shpella Urucit	1560	108	-	1992
14	BB-11	1850	106	-	1993
15	Qafa Pejes	1680	105	54	1993
16	Shpella Fushe Zeze	1500	105	-	1992
17	B-42	2000	104	80	1993

Table 1 : List of the explored caves deeper than 100 m

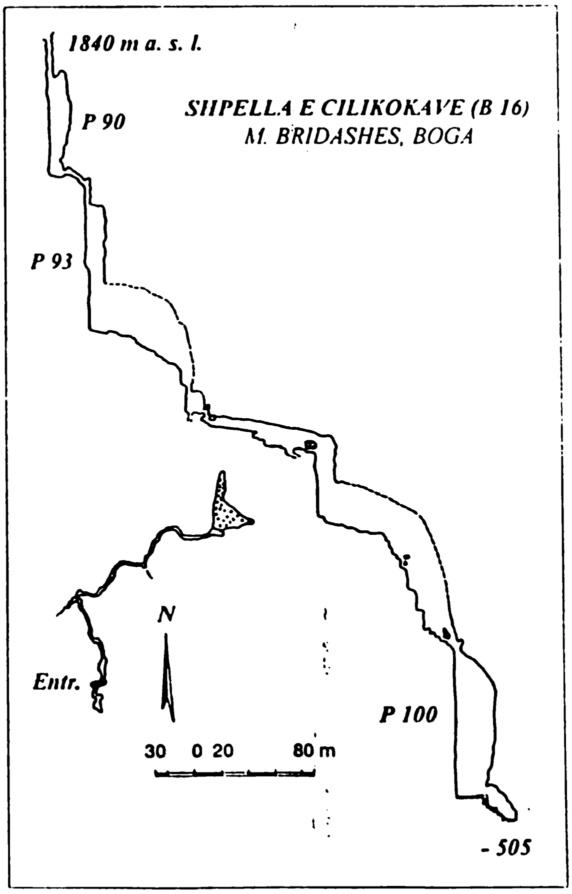

Figure 2 : Map of Shpella Cilikokave

The caves are developed in Jurrasic to Cretoceous limestones with general inclination around 15-25 N-NW. Structural and tectonic information concerning the karstic massif in the Albanian Alps situated NE from Boga village settlement has been analyzed.(SHANOV, 1996). The massif is built up of Jurassic limestones,deformed at the end of the Eocene. The tipe of water-bearing system is jointed-karstic. The direction of the pricipal tectonic stress axes σ 1, σ 2 and σ 3, having acted on the massif from Early Jurassic time up to present days have been determinated by analysing the dispersion of the pairs conjugate shear joints as well as tectonic strations and one fault-plane solution from an earthqake near the region of our investigations. The Pyrenees tectonic phase deformations have favoured opening of the joint systems striking a NE-SW. The deformations in neotectonic phase have formed the secondary joint systems strriking a NW-SE.

Faults play a control role about atmospheric waters drainage as well as about machanical transportaion of debris and deep up to several hundred meter pricipices open around them mainly in brecciated zones. The errosion velocy is dominating on process of massif uplift during the Quternary, and many of superficial karstic forms are filled up by deluvial material.

This systems of fractures determinate the development of most explored caves The analysis of derection of development of 77 explored caves pointed that 39% is developed in NE-SW; 25% in NW-SE; 16% in E-W and 20%- N-S.

The development of surface karst relief is dominated by karst errossion unlike the subsurface karst forms who have mainly corrosional-tectonic origin

The analysis of micro-climatical studies in 12 caves with tipical climate allows to madc the following conclusions: The cave temperature in the zone of constant temperatures is approx. 4° C. In some caves there are negatve temperature anomalies who were determinated from many years snow-ice generations with volume more than 10-15 cub. m. The dynamic of cave atmosphere (V)is in the range 0.005 : 0.020 m/sec. The relative humidity is in the range 85-99% from the warm and 48-70% from the cold caves.

During the expeditions were collected important series of cave Coleoptera, Chilopoda, Diplopoda, Araneida, Copepoda, Opilionida ect. Most of them is still under study in Bulgaria and from foreign specialists and will be described soon.

Acknowledgements

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[illegible] 1996

Cyclopides (Crustacea, Copepoda) des eaux souterraines d`Albanie

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Jusqu`à présent nous ne connaissons pas des publications sur les crustacés des eaux souterraines d`Albanie et sur leur distribution en ce pays. Au mois de mai 1994, grâce à l`aide d`organisation et financière de la Fédération Bulgare de la Spéléologie, au cours d`un séjour de cinq jours en Albanie du Nord nous avons récolté la faune dans deux stations des eaux interstitielles et dans les gours d`une niche pariètale. Dans la présente note nous avons compris aussi le matériel récolté par Monsieur Ljudmil Precroutov dans les lacs souterrains de la grotte "Krevenices" aux environs de la ville de Schkodra.

La détermination taxonomique des échantillons a montré la présence de huite espèces de Cyclopides dont trois d`entre elles sont stygobie: *Diacyclops antrincola, D. paolae* et *D. clandestinus*. Pour les deux premières nous donnons courtes remarques morphologiques et discussions sur leur répartition et variabilité géographique.

Liste des stations

1. Lacs souterrains dans la grotte "Krevenices", village Dajg aux environs de la ville de Schkodra; 2. Eaux interstitielles de la plage de sable et de gravier, la côte d`ouest du lac de Schkodra, à deux km de la frontière avec

Corps semi-transparent, sans tache oculaire. Segment génital un peu plus large que long (largeur/longueur = 1,15/1). Branches furcales 6,6 fois plus longues que larges. Longueur de la soie dorsale - 0,092 mm et de la soie latérale - 0,037 mm. Soie interne apicale de la furca plus longue (0,134 mm) que l`externe (0,082 mm). Formule des pattes thoraciques P1-P4: 3.3/3.3/3.3/3.3. L`article distal de l`endopodite P4 1,9 fois plus long que large, avec l`épine apicale interne 1,2 fois plus longue que l`externe. Les deuxièmes articles des endopodites P2 et P3 portent à une soie. P5 avec l`aspect typique pour l`espèce.

Discussion

L`espèce stygobie *D. antrincola* appartient au groupe des espèces "crassicaudis". Elle a était décrite par Kiefer (1967) des eaux cavernicoles dans l`Italie du Sud et ultérieurement trouvée dans les eaux interstitielles de Montenegro (Petkovski, 1971), dans plusieurs stations en Grèce (y compris quelques îles) (Maggi & Pesce, 1978) et dans des puits d`eau saumâtre et milieu huporhéique en Turquie (Pesce, 1992). Pesce (1980) considère l`espèce comme un élément oriental, nord-méditerranéen des biocoenoses aquatiques souterraines. La station hyporhéique de *D. antrincola* en Albanie s`inscrit dans l`aire de distribution de l`espèce, illustrée par Pesce (1980, p. 6, fig. 2).

Diacyclops paolae Pesce & Galassi, 1987 - fig. 1; d, e, f, g

Matériel examiné. - Station 2, 15.05.1994: 1 ♀.

Faune associée. - Nematoda; Oligochaeta; Mollusca;

Colembolla; Chironomidae; Ostracoda; Cladocera; Harpacticoida; Cyclopoida: *Diacyclops bisetosus*, *Diacyclops lanquidoides* (s. lat.).

Description (femelle)

Longueur totale (sans les soies furcales): 0,532 mm. Largeur maximale du corps dans la partie postérieure du céphalosome: 0,188 mm. Deuxième segment thoracique aussi large que le céphalosome. Antennule (A1) de 11 articles.L'article distale de l'antenne (A2) porte cinq soies dont trois longues et arquées; l'armature des soies des autres articles n'était pas clairement visible. Le segment génital aussi long que large. Branches furcales 3,58 fois plus longues que larges. Soie externe apicale spiniforme de la furca plus longue que l'interne. L'article distal de l'endopodite P4 arrondi, un peu plus long que large (1,06/1); les épines apicales plus courtes de l'article (longueur ép. ap. int. 3enp.P4/longueur ép. ap. ext. 3enp.P4 = 1,1/1).

Discussion

La femelle récoltée dans les eaux interstitielles de la plage du lac de Schkodra diffère du matériel du type d'Italie (Pesce & Galassi, 1987) par son corps plus grand et par la furca allongée (chez les exemplaires de la série typique la furca est jusqu'à 3,3 fois plus longue que large, tandis que chez notre femelle cet indice arrive 3,58). Les autres caractères morphologiques, soulignés par les auteurs de l'espèce (Pesce & Galassi, 1987) comme typiques (la forme

du segment génital et du réceptacle séminal, l'article distal de l'endopodite P4 arrondi, avec deux épines apicales courtes et la forme de la furca) ne montrent pas des différences importantes chez la femelle d'Albanie.

Les eaux interstitielles de la plage sur la côte d'ouest du lac de Schkodra sont pour l'instant la seule station de *D. paolae* sur le territoire de la péninsule Balkanique. Jusqu'à présent l'espèce n'était connue que des eaux phréatiques d'Italie (puits d'eau douce aux environs de Forli, Bologna et Ferrara, Emilia, Apennines Centrales). !!

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The zooplankton from some lakes and ponds in North Albania with different size and altitude

Dimitar KOZUHAROV

The data about the zooplankton in the fresh waters of Albania are not many. The greater part of the investigations has been done on the Scutari lake because of its size - 370 km^2. and the transborder attitude. The investigations on the crustaceans of the Skutari lake particularly started in the beginning of the century (BREM & ZADERBAUER, 1905; VERESHCHAGIN, 1912; GESSENER, 1934; NEDELKOVIC, 1959; PETKOVSKI, 1961). There are no data about the zooplankton of the prevailing part of the numerous small lakes and ponds in the country. There are no data about the rotifers from the Skutari lake either. Eight species of Cyclopoids from the Albanian ground waters were reported by PANDOURSKI (1977).

In July 1995 during a speleological expedition of the Bulgarian Federation of Speleology, zooplankton samples from eight lakes and ponds different in size and hydrological regime, were collected (Fig. 1). The sampling was carried out by an „Apstein" net with 40mkm measure. In the littoral zone of the lakes a hand net was used for the collection of littoral animals.

Fig.1. Map of Albania and the investigated region - marked in the rectangle

Descriptions of the investigated biotops and the methods used for taking samples:

1, 2 Samples - Scutari Lake - geographic position 42.4 N, 19.3E - Surface area 370km^2. 16 m a.s.l., SE coast, first sample taken by a plankton net, second sample taken by a hand net in the littoral zone. Sampling date - 23.06.1995

3 Sample - Artificial lake for agricultural irrigation in the Vrithi village 350 m.a.s.l. - 15.06.1995

4 Sample - Artificial lake for watering above Vrithi village. 1200 m.a.s.l. Sampling date - 15.06.1995

5 Sample - Artificial lake for watering below Vrithi village. Sampling date - 16.06.1995

Table 1

The invertebrate taxa found in the investigated lakes and ponds in the North Albania

Legend: 1, 2 - Scutari lake; 3 - Artificial lake for agricultural irrigation in the Vrithi village; 4 - Artificial lake for watering above Vriti village; 5 - Artificial lake for watering below Vrithi village; 6, 7 - Artificial lake for watering at the Stani I Drugomiri place; 8, 9 - Source at the Proni e Shkurtit place; 10 - Little well at the Stani I Drugomiri place

Taxa	1	2	3	4	5	6	7	8	9	10
Rotatoria										
Lecane (M.) arcuata (Bryce, 1891)		+								
Polyarthra remata Skorikov, 1896	+		+							
Polyarthra sp.	+									
Asplanchna sieboldi (Leidig, 1854)			+							
Asplanchna sp.						+				
Synchaeta sp.						+	+			
Brachionus urceus (L., 1758)						+				
B. urceus sericus Rouselet, 1907						+				
Keratella cochlearis (Gosse, 1851)	+									
K. tecta (Gosse, 1851)	+									
K. quadrata frenzeli (Eckstein, 1895)	+									
Euchlanis dilatata Ehrenberg, 1832	+	+								
Kellicottia longispina (Kellicott, 1879)	+									
Testudinella sp.						+				
Cladocera										
Sida cristalina (O.F. Muller, 1776)	+	+								
Daphnia similis Claus, 1876						+				
D. pulex pulex (De Geer, 1835)			+		+	+				
D. galeata Richard, 1896						+				
Daphnia sp. juv.							+			
D. gr. pulex - ephipia			+		+	+				
D. gr. longispina - ephipia						+	+			
Moina brachiata (Jurine, 1820)			+		+					
Bosmina longirostris (O.F. Muller,1776)	+		+	+						
Acroperus harpae (Baird, 1835)		+								
Alona gutata Sars, 1862		+								
A. rectangula Sars, 1862		+								
Chydorus sphaericus (Muller, !785)		+								
Copepoda										
Eudiaptomus sp. juv.	+									
Eucyclops serrulatus (Fischer, 1853)		+		+						
E. serrulatus proximus (Fischer, 1853)						+	+			
Eucyclops sp.		+								
Trophocyclops prasinus (Fischer, 1860)			+							
Cyclops vicinus Uljanin, 1875	+									
Acanthocyclops vernalis (Fischer, 1860)				+	+	+				
Copepodites	+	+	+	+						

Taxa	1	2	3	4	5	6	7	8	9	10
Nauplii	+	+		+		+				
Others										
Gammarus sp.										+
Asellidae gen. sp.									+	
Coleoptera *Hydrous* sp.							+			
Fam. Chironomidae larvae	+	+							+	
Salamandra larvae									+	
Planaria gen. sp.								+		

6, 7 Samples - Artificial lake for watering, above Rasma village at the Stani I Drugomiri place - 1590 m. a.s.l. - two samples. First taken by a plankton net, second taken by a hand net. Sampling date - 20.06.1995

8, 9 Samples - Source at the Proni e Shkurtit place 1460 m. a.s.l. - two samples, first by plankton net, second by hand net. Sampling date - 21.06.1995.

10 Sample - Little well at the Stani I Drugomiri place. 1590 m.a.s.l. Sampling date - 23.06.1995

All the investigated artificial ponds have an area between 100 and 1000 m^2.

Of all of the investigated waters 14 taxa Rotatoria, 11 taxa Cladocera and 6 taxa Copepoda were established (Table 1). The Cladocera *Daphnia galeata* found in the artificial lake N 6 was not reported for Albania before. PETKOVSKI (1961) reported *Daphnia cuculata* kahlbergensis from the Skutari lake. This species belongs to the same species group without seta comb of longer setae at the base of the postabdominal claws, and the high heads.

Two of the discovered Cyclopoida species from the samples are new for the Albanian fauna - *Tropocyclops prasinus* and *Acanthocyclops vernalis.*

Because of the differences in the hydrological regime of the investigated waters the established species have various ecological characteristics. Some of them are typically pelagic forms like Rotifers *Euchlanis dilatata*, *Keratella cochlearis*, *K. quadrata*, Cladocerans *Sida cristalina*, *Bosmina longirostris* and Cyclopoida species - *Cyclops vicinus* found in the Skutari lake. Others are connected with small water bodies and with the bottom substrate. Such species are rotifer *Lecane (M.) arcuata*, cladocerans *Chydorus sphaericus*, *Alona gutata*, *Alona rectangula*, *Daphnia pulex pulex* and the Cyclopoid *Tropocyclops prasinus*. The greatest variety of species composition was established in the zooplankton from the Skutari lake - 19 species. The poorest samples were from a little well at Stani I Drugomiri place - 1590 m.a.s.l. containing only *Gammarus sp.* The rest of the samples contain between three and ten species.

Most of the established species have a cosmopolitic distribution. Only some of the species are somewhat stenobiontic as for example *Tropocyclops prasinus* found in the artificial lake in the Rasma village. This species is characteristic for the warm waters in the small lakes and ponds, during the summer season. It is monocyclic.

Three mature female individuals found in the lake N 3 are between 750 and 820 mkm long. The latteral parts of the fifth toracal segment are covered by a lot of setae. The furcal rami are short and slightly divergent in their distal parts. They are approximately three times longer as broad. Of the middle appical seta of the furca, the inner one is five times longer than the furcal rami .. The latteral furcal setae are well developed. They are attached to the back 1/3 part of the furcal rami. The antenulae are comparetively short, twelve membered, with dented hyaline membrans of the distal joint. They reach up to the third cephalotoracal segment. P5 is - one somited with three appendages a thin spine in the middle and two setae. The inner one appically situated and the external one subapically situated.

Another species is *Acanthocyclops vernalis* - characteristic for higher altitudes. It was found in the higher artificial ponds situated above Rasma village. In each of the samples in which this species was founded, the number of the individuals was comperatively large. In Bulgaria this species is common for the high mountain glacial lakes in Rila and Pirin mountains over 2095 m.a.s.l. (NAIDENOW, 1975).

The low temperature of the water and the unsustainable hydrological regime are the two main factors responsible for the poor fauna found in the spring and well at the Stani I Drugomiri place. Only four benthic taxa were found in them. The highest situated ponds and sources are much poorer in animals than the lower situated Skutari lake.

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Зоопланктонът от някои водни басейни в Северна Албания с различна големина и надморска височина

Димитър КОЖУХАРОВ

(Р е з ю м е)

Изследвани са зоопланктонни организми от осем различни по размер и хидрологичен режим водни басейна в Северна Албания. Обектите за изследване са разположени от 16 м н.в. до 1560 м н.в. От изследваните обекти са установени 14 - таксона Rotatoria, 11- таксона Cladocera, 6 таксона Cyclopoida (табл. 1). От намерените циклоноиди два вида не са съобщавани за Албания - *Tropocyclops prasinus* и *Acanthocyclops vernalis*, Кладоцерата *Daphnia galeata*, намерена в изкуствено езеро в, също не е съобщавана за Албания. Най-богати са пробите от Шкодренското езеро, а най-малко видове, при това само бентосни, са установени в пробите от кладенчето в местността Стани и Другомири - 1560 м н.в.

Поздравление по случай 110-годишнината на Националния природонаучен музей

ЦАР СИМЕОН II

29.10.1999 г.

Драги Д-р Берон,

С особена радост научих за честването на 110-годишнината от основаването на Националния природонаучен музей.

Отбелязването на този юбилей е гордост за всеки българин, имайки предвид, че създаването му съвпада с първите години от Освобождението ни, и е доказателство за изграждането на интелектуален и научен елит в младата ни държава. Със своя природонаучен музей София се е приближавала до другите модерни европейски столици.

Пожелавам Ви, драги Бероне, в качеството Ви на директор на Музея, да продължавате да пазите и да увеличавате неговата уникална и богата колекция от експонати, с която да привлича посетителите на столицата ни.

Arthropoda Selecta 5 (3/4): 125-130

Notes on the Chilopoda of Albania, 1

Заметки о Chilopoda Албании, 1

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KEY WORDS: Chilopoda, faunistics, taxonomy, Albania.
КЛЮЧЕВЫЕ СЛОВА: Chilopoda, фаунистика, таксономия, Албания.

ABSTRACT: Twenty one centipede species collected in Albania are listed, six of them being new to the Albanian list. A redescription of *Lithobius (Thracolithobius) remyi* Jawlowski, 1933, a little-known troglobiotic centipede, is presented as well. Distributional and ecological data are added coupled with a complete list of Albanian Chilopoda.

РЕЗЮМЕ: Указан собранный в Албании 21 вид губоногих, среди которых шесть — новые для албанской фауны. Приведено также переописание плохоизвестной троглобионтной костянки *Lithobius (Thracolithobius) remyi* Jawlowski, 1933. Представлены данные по распространению и экологии вместе с полным списком Chilopoda Албании.

Introduction

The Albanian centipede fauna is still very poorly known. Some scanty data on chilopods can be found only in the works of Verhoeff [1905, 1909, 1933, 1934, 1937, 1941, 1944], Manfredi [1932, 1945], Attems [1929, 1959], and Kanellis [1959]. For the last 35 years, there has been no publication concerning Albanian Chilopoda. Some of these older materials have been revised by Eason [1969], Zapparoli [1992, 1994], Zapparoli & Minelli [1993].

This paper is devoted to the treatment of a considerable collection of centipedes taken recently by Dr. Petar Beron (P.B.), Boyan Petrov (B.P.), Desislava Zaprianova (D.Z.), Teodora Ivanova (T.I.), Petar Tenchev (P.T.), Todor Troanski (T.T.) and myself (P.S.). This collection is housed in the National Museum of Natural History, Sofia, and contains 21 species. Among these, six are new to the fauna of Albania, and one of them is redescribed as being particularly poorly known. A list of Albanian Chilopoda is provided herewith as well.

Systematic account

Eupolybothrus fasciatus (Newport, 1845)

Albania: Kačanic, Ljubcten, "Drinursprung": Attems, 1929: 305 (sub *Polybothrus fasciatus bosniensis* Verhoeff, 1900); Zavalan: Manfredi, 1932: 112 (sub *Polybothrus fasciatus*); Terpan, Ramia: Manfredi, 1945: 23 (sub *Polybothrus fasciatus bosniensis*).

Material: 1 ♂, 1 juv., Shkodër Distr., village Boga, Maya Tchardakut, 1200-1400 m, 1.05.1993; 1 ♂, 2 ♀♀, same locality, 1400-1600 m, 1-2.06.1993; 2 ♂♂, 1 ♀, same locality, 1600-1800 m, 2.06.1993; 1 ♂, 1 ♀, Shkodër Distr., village Theth, 800-900 m, 28.05.1993; 4 ♂♂, 1 ♀, Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993, all leg. P.B.; 1 ♂, 1 ♀, same locality, 1008 m, 3-4.06.1993; 3 ♂♂, 3 ♀♀, Upper Camp, 1800-1900 m, 20-23.05.1993, all leg. P.B. & B.P.; 1 ex., Shkodër Distr., M. e. Radohimës 1900-2200 m, 28.05.1993; 2 ♂♂, 1 ♀, same locality, 2200-2400 m, 29.05.1993, all leg. P.B.; 1 juv. ♂, Saranda Distr., village Qeparo, under stones, 4-5.05.1994; 3♂♂, 1♀, Gjirokaster, castle, under stones, 6.05.1994, all leg. P.S.

Remarks: This species is known also from Italy, Croatia, Bosnia & Herzegovina, Montenegro, and Bulgaria.

Eupolybothrus litoralis (L. Koch, 1867)

Material: 1♀, Shkodër Distr., village Boga, Maya Tchardakut, 1200-1400 m, 1.06.1993, leg. P.B.

Remarks: From Albania alone, Verhoeff [1934] erected two subspecies of *Eupolybothrus fasciatus*: *E. f. storkani* and *E. f. albanicus*, the second based only on a single ♀. Re-examination of the types or topotypes is badly needed, and synonymization can well be suspected with some of the well-known *Eupolybothrus* species of the *fasciatus-litoralis* group. The above species is new to the Albanian fauna, known also from Greece, Montenegro, Bosnia & Herzegovina, Croatia, Slovenia, Bulgaria, Turkey, Lebanon, Jordan, Palestina, Syria and (?) Cyprus.

Eupolybothrus caesar (Verhoeff, 1899)

Albania: "Mali Senjt bei Oroshi": Attems, 1929: 305 (sub *Polybothrus caesar*).

Material: 1 ♀, Tepelene Distr., village Mezgorani, Cave Mezgorani, 2.06.1994, leg. T.I.; 1 ♂, 1 ♀, Gjirokaster, castle, under stones, 6.05.1994; 1 ♂, 1 ♀, Ionian coast, Saranda Distr., village Borsh, under stones, 5.05.1994; 1 juv. ♂, 1 ♀, Saranda Distr., village Dhërmi, under stones, 2.05.1994, all leg. P.S.

Remarks: *E. caesar* is distributed also in continental Greece, Kerkira (Corfu) Island, Bosnia & Herzegovina. *Polybothrus caesar valonensis* (Verhoeff, 1905), erected from Albania, probably belongs to the widespread West Balkan endemic *Eupolybothrus caesar caesar* (Verhoeff, 1899).

Lithobius forficatus (Linnaeus, 1758)

Albania: Ljubeten: Attems, 1929: 300.

Material: 1 ♀, Shkodër Distr., village Theth, 800-900 m, 28.05.1993, leg. P.B.

Remarks: This is one of the most common European species inclined to synanthropization.

Lithobius peregrinus Latzel, 1880

Albania: Ljubeten, Kacanic, Neres, Treska, Cviljen, Kalkandelen, Oroshi, Maranaj: Attems, 1929: 300 (sub *Lithobius romanus* Meinert, 1872); Lusmja, Karbunara, Terpan: Manfredi, 1945: 23 (sub *Lithobius piceus peregrinus* Latzel, 1880); Oberes Valboni-Tal, "zw. Mal i Ribes u. Stan i Ribes, "Fuss des Baschtrik bei Kishas", "Mali Senjt bei Oroshi", Gjallicn: Zapparoli, 1992: 163.

Material: 3 ♂♂, 1 ♀, Shkodër Distr., village Boga, Maya Tchardakut, 1200-1400 m, 1.06.1993; 1 ♂, same locality, 1600-1800 m, 2.06.1993; 2♀♀,♂, Shkodër Distr., village Theth, 800-900 m, 28.05.1993, all leg. P.B.

Remarks: A widespread, probably submountainous centipede [cf. Zapparoli, 1992], it has already been recorded in Albania by Attems [1929] as *Lithobius romanus*, by Manfredi [1945] as *L. piceus peregrinus*, and by Zapparoli [1992] as *L. peregrinus*.

Lithobius viriatus Sseliwanoff, 1878

Material: 1 ♀, Durrës, amphitheatre, 12.06.1993, leg. B.P.; 1 juv. ♀, Durrës, 24.05.1993; 2 ♂♂, 2 ♀♀ juv., Vlorë, under stones & in soil, 1.05.1994, all leg. P.S. & D.Z.; 1♀, 4 km S of Vlorë, under stones, 1.05.1994, leg. P.S.; 1♀, 2 juv., 1 larva, Ionian coast, Saranda Distr., village Lukove, under stones, 5.05.1994, leg. P.S. & D.Z.; 1 ♂, Saranda Distr., village Borsh, under stones, 5.05.1994, leg. P.S.

Remarks: A species new to the Albanian fauna, known also from SE Italy, Greece, Bulgaria, Turkey, Crimea, Caucasus, Palestina and NW-Iran, Bosnia & Herzegovina (?).

Lithobius erythrocephalus C.L. Koch, 1847

Albania: Ljubeten: Attems, 1929: 301 (sub *Archilithobius erythrocephalus* (C.L.Koch, 1847)); Pëdhane, W coast of Shkodër Lake, Shkodër, Siroka, Zavalan: Manfredi, 1932: 112.

Material: 1 ♀, Shkodër Distr., village Theth, 800-900 m, 28.05.1993; 1 ♀, Shkodër Distr., village Theth to village Boga, near artificial lake, 1200 m, 30.05.1993, all leg. P.B.; 1 ex., 4 km S of Vlorë, under stones, 1.05.1994; 2♂♂, Ionian coast, Saranda Distr., between villages Dhërmi & Himarë, under stones, 3.05.1994, all leg. P.S.; 1♀, Korcë Distr., Pass Q. e. Qarrit 1.06.1994, leg. T.I.; 1 ♀, village Dhërmi, under stones, 2.05.1994, leg. P.S.

Remarks: A widespread European species, it seems to be fairly common in Albania.

Lithobius schuleri Verhoeff, 1925

Material: 1 ♀, Shkodër Distr., village Theth, 800-900 m, 28.05.1993; 2♀♀, Shkodër Distr., village Boga, Maya Tchardakut, 1400-1600 m, 1.06.1993; 3 ♂♂, 2 ♀♀, same locality, 1400-1800 m, 1.06.1993, all leg. P.B.; 1♂, 1♀, village Boga, soil trap, 06.1993, leg. P.B. & B.P.; 1 ♀, Shkodër Distr., Alpet M. e. Radohimës, 1900-2200 m, 28.05.1993; 5 ♂♂, 4 ♀♀, M. e. Radohimës, 2200-2400 m, 29.05.1993; 6 ♂♂, 4 ♀♀, Alpet M. e. Radohimës, 2400-2550 m, 29.05.1993, all leg. P.B.; 6♂♂, 3♀♀, village Boga, Upper Camp, 1800-1900 m, 20-23.06.1993, leg. P.B. & B.P.; 1 ♀, village Boga, 1500 m, cave B-52, 18.06.1994, leg. T. Troanski.

Remarks: A species new to the Albanian fauna, typical for the mountains and sympatric with *L. erythrocephalus*, *Lithobius schuleri* is known also from NE-Italy, Greece, Bulgaria, Rumania, Austria, Switzerland, Hungary and Poland.

Lithobius latro Meinert, 1872

Material: 1 ♀, Shkodër Distr., Alpet M. e. Radohimës, 1900-2200 m, 28.05.1993, leg. P.B.

Remarks: A species new to the Albanian fauna, *L. latro* is well represented high in the mountains. Known also from NE-Italy, Greece, Croatia, Slovenia, Bosnia & Herzegovina, Bulgaria, Rumania, Ukraine, Austria, Switzerland, S-Germany and Czechoslovakia.

Lithobius lucifugus L. Koch, 1862

Albania: Shkodër, Maranaj, Ivanova Aluga: Attems, 1929: 301 (sub *Archilithobius lucifugus* (L. Koch, 1862)).

Material: 2 juv. ♀♀, 1 ♂, Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993; 1 ♀, village Boga, Upper Camp, 1800-1900 m, 20-23.06.1993, all leg. P.B. & B.P.

Remarks: A widespread European species, *L. lucifugus* has already been recorded in Albania by Attems [1929].

Lithobius (Monotarsobius) crassipes (L. Koch, 1862)

Albania: Zljeb: Attems, 1929: 304.

Material: 1 ♂, Albanian-Macedonian border, Čafa-san, 1150 m, 27.05.1993, leg. P.S. & D.Z.

Remarks: A widespread European species.

Lithobius (Thracolithobius) remyi Jawlowski, 1933

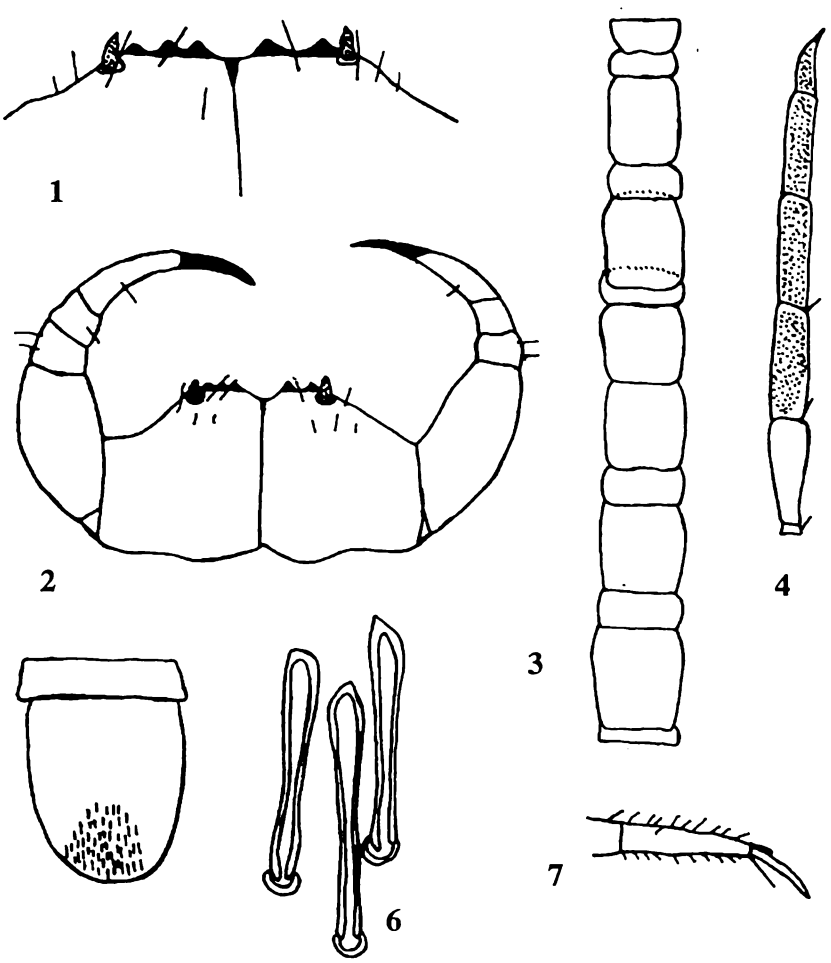
Figs 1-7.

Material: 1 ♂, Rrëshen Distr., village Merkurth, Cave Merkurth, 11.06.1993, leg. P.B. & B.P.

Description of the ♂: Colour pale yellow. Size: 12 mm long, 1.2 mm broad. Head longer than broad. Antennae 6.8 mm long, almost reaching to tergite 8, composed of 56-59 segments. Terminal article twice as long as broad. Ocelli absent. Tömösváry organ very large. Prosternum

Table.1 Spinulation of *Lithobius (Thracolithobius) remyi*.

N	Ventral					Dorsal				
	Cx	Tr	Pf	F	Ti	Cx	Tr	Pf	F	Ti
1				m	m					a
2				m	m					a
3				m	m					a
4				m	m					a
5				m	m					a
6				m	m					a
7				m	m					a
8				m	m					a
9				m	m					a
10				m	m					a
11			m	m	m					a
12			m	mp	m					a
13			mp	mp	m			p		a
14		m	mp	m				mp		
15		m	mp	m				mp		



Figs 1-7. *Lithobius (Thracolithobius) remyi* Jawlowski, 1933: 1 — dental margin of prosternum, ventral; 2 — prosternum with forcipules and poison claws, ventral; 3 — tergites 1-13, dorsal; 4 — leg 15 with glandular pores, mesal; 5 — tergite 14 with a field of fine setae; 6 — setae on tergite 14 (strongly enlarged, after Jawlowski [1933]); 7 — metatarsus 13 with claws (after Jawlowski [1933]).

Рис. 1-7. *Lithobius (Thracolithobius) remyi* Jawlowski, 1933: 1 — зубной край простернума, вентрально; 2 — простернум с ногочелюстями и ядовитыми коготками, вентрально; 3 — тергиты 1-13, дорсально; 4 — нога 15 с железистыми порами, изнутри; 5 — тергит 14 с полем тонких щетинок; 6 — щетинки на тергите 14 (сильно увеличено, по Jawlowski [1933]); 7 — метатарзус 13 с коготками (по Jawlowski [1933]).

with 2+3 blunt teeth and very stout lateral porodonts (Figs 1-2). Forcipules prolonged (like in most troglobionts) (Fig. 2). Tergites: T.1 semicircular, narrower than T.3; all large tergites longer than broad; T.9, T.11 and T.13 without triangular projections; T.14 completly rounded like a vizor (Fig. 5), posterior 1/3 T.14 being covered with a field of fine setae (Figs. 5-6). Coxal pores small, circular: 2, 2, 4, 3 – 3, 3, 3, 3. All legs with biarticulate tarsi. Legpairs 14-15 without accessory claw, legpairs 1-13 each with two accessory claws (Fig. 7). Last ♂ legpair without special modifications. Glandular pores in internal aspect restricted only to ♂ femur, tibia, tarsus and metatarsus 14 and 15 (Fig. 4). Legpairs 14-15 flattened on internal side. ♂ genitalia: first genital sternite with 17 setae, second without setae.

Spinulation as in Tab. 1.

Remarks: Jawlowski [1933] described *Lithobius remyi* based on 3 ♂♂ and 1 ♀ collected by P. Remy in Gradje pecina, Serbia. Subsequently, Matic [1962] has keyed *Lithobius remyi*, *L. dacicus* Matic, 1959, and *L. inexpectatus* Matic, 1962 within the subgenus *Thracolithobius* Matic, 1962, giving the following diagnosis of the subgenus ~~former species~~: body medium-sized (12-15 mm.), antennae with of 37-61 segments, ocelli 0-14, prosternal teeth 2+2 to 3+3; all tergites without projections, anterior edge of tergite 14 completely rounded like a vizor.

To date, these three species are known to occur only in Rrmania, Serbia, and Albania. Surprisingly, *L. remyi*, a typical cave-dweller, appears to inhabit a relatively vast area, including central North Albania and Serbia. As far

as I know, only *Lithobius lakatnicensis* Verhoeff, 1926, another troglobiotic lithobiomorph, is similarly widely distributed: central and West Bulgaria, East Serbia. *L. remyi* is a species new to the Albanian fauna.

Biology: There is also *Albanotrechus beroni* Casale & Guéorguiev, 1995, a troglobiotic trechine occurring in Cave Merkurth together with *Lithobius (T.) remyi*.

Pleurolithobius patriarchalis (Berlese, 1894)

Albania: Neres, Kačanic, Mesi bei Shkodër (Skutari): Attems, 1929: 304 (sub *Pleurolithobius ionicus*); Jablanica, Korab Geb.: Verhoeff, 1934: 58 (sub *Pleurolithobius jonicus porosus* Verhoeff, 1934); Terpan, Lusmja: Manfredi, 1945: 23 (sub *Pleurolithobius jonicus porosus*); Valona, Crni Kamen, Nerez Gornya Voda, Lusmian, Kacanich: Zapparoli & Minelli, 1993: 334-335.

Material: 3 ♀♀, 2 ♂♂, Gjirokaster, castle, under stones 6.05.1994; 7 ♀♀, Ionian coast, Saranda Distr., village Himarë, under stones 3-4.05.1994, all leg. P.S.

Remarks: *P. patriarchalis* seems to be one of the most common Albanian chilopods.

Harpolithobius anodus (Latzel, 1880)

Albania: Neres, Kacanic, Ljubeten, Vermosa, "Drinursprung": Attems, 1929: 304.

Material: 1 ♀, 1 juv. ♂, Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993; 1 ♂, village Boga, Upper Camp, 1800-1900 m, 20-23.06.1993, all leg. P.B. & B.P.; 1 ♀, 1 juv. ♂, village Boga, Maya Tchardakut, 1400-1600 m, 1.06.1993, leg P.B.

Remarks: *H. anodus* is known also from Italy, Greece, Slovenia, Croatia, Montenegro, Bosnia & Herzegovina, Bulgaria, Romania, Austria, Ukraine, Turkey, Caucasus, Hungary, Czechoslovakia and Poland.

Scolopendra cingulata Latreille, 1829

Albania: "bei Reči": Verhoeff, 1909: 716; Pëdhane, Mali Grad: Manfredi, 1932: 111; "Krionero pr. Valona, Poggio Boschetto, Terpan (Berati), Karbunara pr. Lusmja, Lusmja, Fushes Dukati": Manfredi, 1945: 22.

Material: 5 ex., 4 km N of Durrës, under stones, 25-26.05.1993; 1 ex., Tirana, 13.06.1993, all leg. P.B. & B.P.; 2 ex., Saranda Distr., village Lukove, under stones, 5.05.1994, leg. P.S. & D.Z.; 4 ex., Saranda Distr., village Dhërmi, under stones, 2-3.05.1994; 1 ex., Përmet Distr., between villages Charshove & Leskovik, under stones, 7.05.1994, all leg. P.S.; 4 ex., Korcë Distr., Pass Q. e. Qarrit, 1.06 1994, leg. T.I.; 4 ex., Vlorë, under stones, 1.05.1994; 1 ex., 4 km S of Vlorë, under stones, 1.05 1994, all leg. P.S. & D.Z.; 1 ex., Saranda Distr., village Himarë, under stones, 3-4.05.1994; 1 ex., Saranda Distr., village Borsh, under stones, 5.05.1994; 2 ex., Gjirokaster, castle, under stones, 6.05.1994, all leg. P.S.

Remarks: Undoubtedly, this species is one of the commonest Albanian scolopendrids, recorded in Albania also by Verhoeff [1909] and Manfredi [1932, 1945].

Scolopendra dalmatica C.L. Koch, 1847

Albania: Velipolja: Attems, 1929: 299 (sub *Rhadinoscytalis dalmatica* Attems); Shkodër, Siroka, Pëdhane: Manfredi, 1932: 111 (sub *Scolopendra (Rhadinoscytalis) dalmatica* C.L. Koch, 1847).

Material: 2 ex., Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993, leg. P.B. & B.P.

Remarks: The above locality is not far away from the known records (near 50 air-km). Reported also from Greece, Croatia, Bosnia & Herzegovina, and Montenegro.

Cryptops hortensis Leach, 1814

Albania: 3 km SW of Qukesit, Pëdhane (?): Manfredi, 1932: 112.

Material: 1 ex., Shkodër Distr., village Theth, 800-900 m, 28.05.1993, leg. P.B.; 1 ex., Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993; 2 ex., village Boga, Upper Camp, 1800-1900 m, 20-23.06.1993, all leg. P.B.& B.P.; 1 ex., Shkodër Distr., Alpet, M. e. Radohimës, 1900-2200 m, 28.05.1993; 3 ex., same locality, 2200-2400 m, 29.05.1993, all leg. P.B.; 1 ex., Ionian coast, Saranda Distr., village Dhërmi, under stones, 2.05.1994, leg. P.S.

Remarks: A widespread Palearctic species obviously fairly common in Albania.

Cryptops parisi Brolemann, 1920

Material: 4 ex., Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993, leg. P.B. & B.P.; 1 ex., Shkodër Distr., M. e. Radohimës, 2200-2400 m. 29.05.1993, leg. P.B.; 1 ex., Ionian coast, 4 km S of Vlorë, under stones, 1.05.1994; 1 ex., Saranda Distr., village Dhërmi, under stones, 2.05.1994, all leg. P.S.

Remarks: Although *C. parisi* has long been put on Attems' [1959] list of Albanian Chilopoda, I have failed to trace any exact faunistic literature record of this common European species.

Cryptops rucneri Matic, 1967

Material: 1 ex., Shkodër Distr., village Theth, 800-900 m, 28.05.1993, leg. P.B.

Remarks: A species new to the Albanian fauna, *C. rucneri* is known also from Italy, Bulgaria, Croatia, Romania and Austria.

Cryptops croaticus Verhoeff, 1931

Material: 1 ex., Shkodër Distr., village Boga, 1000-1100 m, 5-9.06.1993, leg. P.B. & B.P.

Remarks: This species has been reported in Albania by Verhoeff [1934] as a new subspecies named *Cryptops croaticus albanicus*. Somewhat later, however, Verhoeff [1938: 364] transferred *C. croaticus albanicus* as a subspecies of *C. anomalans*, making a new combination. Recently, Zapparoli [in press] has provided evidence of strict synonymy between *C. anomalans albanicus* Verhoeff, 1934, and *C. anomalans* Newport, 1844. This species is known also from Italy, Greece, Slovenia, Croatia, Bosnia & Herzegovina, Bulgaria, Romania and Ukraine.

Scutigera coleoptrata (Linnaeus, 1758)

Albania: Prizren: Attems, 1929: 306; W coast of Lake Shkodër, Pëdhane: Manfredi, 1932: 112; Karbunara pr. Lusmja: Manfredi, 1945: 25.

Material: 2 ex., 2 km N of Durrës, under stones, 24.05.1993, leg. P.S. & D.Z.

Remarks: A Mediterranean species widely distributed through human agency also in North America and Central Europe. This seems a very common centipede in Albania.

A checklist of Albanian chilopods*

1a *Eupolybothrus fasciatus fasciatus* (Newport, 1845)

* This list covers also several places in former Yugoslavia adjacent to Albania proper, which were reported by Attems [1929, 1959].

1b *E. fasciatus storkani* Verhoeff, 1934
1c *E. fasciatus albanicus* Verhoeff,1934
1d *E. fasciatus presbanus* (Verhoeff, 1941)
2 *E. litoralis* (L. Koch, 1867)
3a *E. caesar caesar* (Verhoeff, 1899)
3b *E. caesar valonensis* (Verhoeff, 1905)
4 *E. herzegowinensis* (Verhoeff, 1900)
5 *E. tridentinus* (Fanzago, 1874)
6 *E. transsylvanicus* (Latzel, 1882)
7 *Lithobius* (s.str.) *castaneus* Newport, 1844
8 *L. dentatus* C.L. Koch, 1844
9 *L. dubius* Tömösváry, 1880**
10 *L. forficatus* (Linnaeus, 1758)
11a *L. erythrocephalus erythrocephalus* C.L. Koch, 1847
11b *L. erythrocephalus montanus* Attems, 1929
12 *L. lapidicola* Meinert, 1872
13 *L. latro* Meinert, 1872
14 *L. lucifugus* L. Koch, 1862
15 *L. muticus* C.L. Koch, 1847
16 *L. peregrinus* Latzel, 1880
17 *L. schuleri* Verhoeff, 1925
18 *L. tenebrosus* Meinert, 1872
19 *L. tricuspis* Meinert, 1872
20 *L. validus* Meinert, 1872
21 *L. viriatus* Sseliwanoff, 1878
22 *L. (Thracolithobius) remyi* Jawlowski, 1933
23 *L. (Sigibius) trebinjanus* Verhoeff, 1900
24 *L. (S.) burzenlandicus wardaranus* (Verhoeff, 1937)
25 *L. (S.) microps* Auct., nec Meinert, 1868
26 *Lithobius (Monotarsobius) aeruginosus* L. Koch, 1862
27 *L. (M.) crassipes* L. Koch, 1862
28 *Pleurolithobius patriarchalis* (Berlese, 1894)
29 *Harpolithobius anodus* (Latzel, 1880)
30 *H. ljubetensis* Verhoeff, 1934
31 *Scutigera coleoptrata* (Linnaeus, 1758)
32 *Scolopendra cingulata* Latreille, 1829
33 *S. dalmatica* C.L. Koch, 1847
34 *Cryptops anomalans* Newport, 1844
35 *C. croaticus* Verhoeff, 1931
36 *C. hortensis* Leach, 1815
37 *C. parisi* Brolemann, 1920
38 *C. rucneri* Matic, 1967
39 *Himantarium gabrielis* (Linnaeus, 1767)
40a *Stigmatogaster gracilis gracilis* (Meinert, 1870)
40b *S. gracilis occitanica* Ribaut, 1910
41 *Schendyla montana* Attems, 1895
42 *Clinopodes flavidus* C.L. Koch, 1847
43 *C. escherichii* (Verhoeff, 1896)
44 *C. polythrichus* (Attems, 1903)
45 *C. scopliensis* (Verhoeff, 1938)
46 *C. trebevicensis* (Verhoeff, 1898)
47 *Geophilus carpophagus* Leach, 1815
48 *Simophilus albaniensis* Attems, 1929
49 *Strigamia acuminata* (Leach, 1815)
50 *S. crassipes* (C.L. Koch, 1835)
51 *Henia crinita* Attems, 1903
52a *H. illyrica illyrica* (Meinert, 1870)
52b *H. illyrica oblonga* Verhoeff, 1934
53 *H. devia* C.L. Koch, 1847
54 *Dignathodon microcephalum* (Lucas, 1846)

** Under this name, both *L. erythrocephalus* and *L. mutabilis* L. Koch, 1862, are known.

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sumption of *F. candida* than *R. padi*. One explanation could be that *R. padi* contains feeding deterrents (BILDE, TOFT, 1994) but *F. candida* does not. This would make *F. candida* more palatable to the spiders despite its increased harmfulness. It is still unclear, though, why so many spiders developed an aversion to *R. padi* but not to *F. candida*. The reason may be that slow-acting toxins cause the toxicity of *F. candida*. It would then be difficult for the spider to associate delayed post-digestive effects with the prey. Another possibility is that the spiders may be unable to develop aversions to palatable food items (LEE, BERNAYS 1990).

An earlier study has shown that spiders recently caught in the field, on average eat 2.6 *R. padi* before an aversion develops (TOFT, 1997). In the present study, however, most of the spiders completely avoided the aphids at the first encounter (cf. Fig. 3). This neophobia may be an effect of raising the spiders on a monotypic diet of highly palatable fruit flies. However, the spiders did feed on the aphids during the 24-hour food consumption study. The neophobia was therefore quickly overcome.

In conclusion, nutrient deficiency influences not only survival and growth of spiders (MAYNTZ, TOFT, in prep.) but also the acceptance of some low quality prey types.

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CONTRIBUTION TO THE KNOWLEDGE OF THE HARVESTMEN (ARACHNIDA: OPILIONES) OF ALBANIA

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Abstract

MITOV P.: Contribution to the knowledge of the harvestmen (Arachnida: Opiliones) of Albania. In GAJDOŠ P., PEKÁR S. (eds): Proceedings of the 18th European Colloquium of Arachnology, Stará Lesná, 1999. Ekológia (Bratislava), Vol. 19, Supplement 3/2000, p. 159-169.

The opilionid fauna of Albania is still poorly known. In the entire literature on this topic from the territory of this country are recorded 31 species, some of which have vague taxonomical status or need confirmation. As a result of examination of material from the collections of the author and of the National Museum of Natural History in Sofia, 20 species were established altogether. Ten of these (*Paranemastoma titaniacum* (ROEWER), *Mitostoma cancellatum* (ROEWER), *Trogulus nepaeformis* (SCOPOLI), *Opilio saxatilis* C. L. KOCH, *Opilio transversalis* ROEWER, *Metaplatybunus carneluttii* HADŽI, *Metaplatybunus strigosus* (L. KOCH), *Rilaena balcanica* ŠILHAVÝ, *Lacinius dentiger* (C. L. KOCH), *Amilenus aurantiacus* (SIMON)) are new to the Albanian fauna. For the other 10 species (*Paranemastoma longipes* (SCHENKEL), *Mediostoma humerale* (C. L. KOCH), *Trogulus tricarinatus* (LINNAEUS), *Trogulus graecus* DAHL, *Dicranolasma scabrum* (HERBST), *Metaphalangium cirtanum* (C. L. KOCH), *Opilio parietinus* (DE GEER), *Metaplatybunus grandissimus* (C. L. KOCH), *Lacinius horridus* (PANZER), *Nelima troglodytes* ROEWER) new chorological data are provided.

Introduction

The opilionid fauna of Albania is still poorly known. In the entire literature on this topic (ROEWER, 1914, 1917, 1923, 1950, 1951, 1956, 1957; STRAND, 1919; KOLOSVÁRY, 1940; KRATOCHVÍL, 1937, 1946; SCHENKEL, 1947; RAFALSKI, 1956; ŠILHAVÝ, 1956; KRAUS, 1961; STARĘGA, 1973, 1976a, b; GRUBER, 1974; MARTENS, 1978; KARAMAN, 1995; KOMPOSCH, 2000) from the territory of this country 31 species are recorded, some of them still have vague taxonomical status or are in need of confirmation. These data will be published separately in the future.

Only the papers of STRAND (1919), KOLOSVÁRY (1940) and SCHENKEL (1947) are especially dedicated to the Albanian opilionid fauna. Since these works, no further faunistic data for Albania have been published . Thanks to the Bulgarian expeditions carried out in the period 1992-1995 a significant amount of material was gathered, and so it became possible to make more precise statements on the composition of the opilionid fauna of this interesting country

Material and methods

The material was collected as follows: 1) on private collecting trips of Stoyan Beshkov (S.B.) (June 1992, April 1994, June 1995), Pavel Stoev (P.S.) and Desislava Zapryanova (D.S.) (May 1994), Petar Tenchev (P.T.) (May 1995), Stanislav Abadzhiev (S.A.) (June 1995), Gergin Blagoev (G.B.) (May 1994, June 1995) through Albania; 2) during expeditions of the BFS and MNHS by Petar Beron (P.B.) and Boyan Petrov (B.P.) (May-June 1993), Teodora Ivanova (T.I.) and Alexej Zhalov (A.Z.) (May-June 1994) and 3) on the I[st] "PENSOFT" Albanian expedition by Sergey Golovach (S.G.), Pavel Stoev and Boyan Petrov (May 1995). The material is in the collection of the author and of MNHS (Inv. Nrs. 399-413).

The map of Albania was kindly provided by Pavel Stoev. The names of the localities, given on Fig. 1 can be found in some other maps (see Shqipëria. Karte rrugore (Albania. Road map). M 1: 400 000, Rruga Myslym Keta Tiranë, 1993) with different names, which are given in brackets below: Bogë (Boga), Burrel (Burreli), Dajti Mt. (Dajtit Mt.), Dhërmi (Dhënniu), Durrës (Durres, Durrësi), Gjirokaster (Gjirokastra), Himarë (Himara), Kamenice (Kamenica), Korcë (Korçe, Korça), Kula Lums (Kula Ljums, Kula e Lumës), Leskovik (Leskoviku), Librazhd (Librazhdi), Llogorasë Pass (Llogara Pass), Paštnk (Pashtrik; Pushtrikut, Beshtriqu), Prenjas (Perrenjasi), Sarandë (Sarande, Saranda), Shkodër (Shkoder, Shkodra), Tirana (Tirane), Vlorë (Vlore, Vlora), Vrissara (Vriscraja).

Abbreviations used: v.- village, BFS- Bulgarian Federation of Speleology, Sofia, MNHS- National Museum of Natural History in Sofia.

Species list

As a result of examination of material from the collections of the author and of the National Museum of Natural History in Sofia, a total of 20 species was established. Ten of them, marked in the text with asterisks, are new to the Albanian fauna.

Nemastomatidae SIMON, 1872

1) *Paranemastoma longipes* (SCHENKEL, 1947) (Fig. 2)

Nemastoma gigas longipes SCHENKEL, 1947: 10, f. 3 (Albania: "Tirana");
Nemastoma longipes (SCHENKEL, 1947): ROEWER, 1951: 116 (Albania: "Tirana")

Material: Tirana Distr., city of Burreli, rock niche, 16.V.1994, leg. A.Z. (1 ♀); Tirana Distr., v. Vorra, 27.VI.1995, leg. S.A. (2 ♂♂, 1 ♀); Tirana Distr., v. Petrela, 300 m a.s.l., artificial galleries on the road, 09.V.1995, leg. P.S. and B.P. (6 ♂♂, 6 ♀♀, 1 juv.); Sarandë Distr., Ionian coast, v. Dhërmi, 100 m a.s.l., leaf litter, 11.V.1995, leg. S.G., P.S. and B.P. (3 juv. (2.6-3.1 mm)).

Distribution: Bosnia and Herzegovina (sub *Nemastoma (Dromedostoma) longipes* (SCHENKEL, 1947))(HADŽI, 1973b).

2) * *Paranemastoma titaniacum* (ROEWER, 1914) (Fig. 2)

Material: Mt. Prokletic, Shkodër Distr., v. Bogë, cave No 25, 23.V.1993, leg. P.B. and B.P. (1 ♂, 2 ♀♀, 1 juv. MHNS: No 400); the same locality, cave No 32, 02.VI.1993, leg. P.B. (1 ♀. MHNS: No 413).

Distribution: Croatia, Bosnia, E Herzegovina, Montenegro (ROEWER, 1914, 1917, 1923, 1951; HADŽI, 1973b; KARAMAN, 1995).

3) *Mediostoma humerale* (C. L. KOCH, 1839) (Fig. 2)

Nemastoma quadripunctatum-humerale (C. L. KOCH, 1839): ROEWER, 1914: 148 ("Albanien: Ochrida"); ROEWER, 1923: 663 ("Albanien: Ochrida");
Nemastoma quadripunctatum var. humerale (C. L. KOCH): ROEWER, 1917: 147 ("Albanien: Ochrida");
Nemastoma humerale C. L. KOCH 1839: ŠILHAVY, 1956: 143 ("Albánie").

Material: Vlorë Distr., v. Dukati, 450 m a.s.l., leaf litter, 11.V.1995, leg. S.G., P.S. and B.P. (1 ♂, 1 ♀, 2 juv.); Sarandë Distr., Ionian coast, v. Dhërmi, under stones, 02.V.1994, leg P.S. (2♂♂ 2 ♀♀); the same locality, [illegible]0 m a.s.l., leaf litter, 11.V.1995, leg. S.G., P.S. and B.P. (1 juv.); Sarandë Distr., Ionian coast, v. Lukove, under stones, 05.V.1994, leg. P.S. and D.Z. (3 ♂♂, 2 ♀♀); Gjirokaster, the castle, under stones, 06.V.1994, leg. P.S. (1 ♀); Sarandë Distr., Ionian coast, v. Butrinti, 04.VI.1995, leg. G.B. (1 ♀).

Distribution: Greece, S Serbia (ROEWER, 1914, 1917, 1923, 1951; HADŽI, 1927; ŠILHAVY, 1956; GRUBER, 1976; RAMBLA, 1976). According to J. GRUBER (pers. comm.) the records from Romania, Bavaria and Switzerland are erroneous and are based on ROEWER (1914).

Remarks: GRUBER (1976) synonymized *Nemastoma graecum* ROEWER, 1917 sub *Nemastoma humerale* C. L. KOCH, 1839 and placed the latter in *Mediostoma* KRATOCHVIL, 1958.

4) * *Mitostoma cancellatum* (ROEWER, 1917) (Fig. 2)

Material: Leskovik Distr., cave near the road Permet (Permeti)-Leskovik (5 km before Leskovik), 900 m a.s.l., 12.V.1995, leg. P.S. and B.P. (1 ♂, 2 ♀♀, 1 juv.).

Distribution: Bosnia and Herzegovina, Montenegro, Serbia (ROEWER, 1917, 1923, 1951; ŠILHAVY, 1939; HADŽI, 1973a; KARAMAN, 1995).

Dicranolasmatidae SIMON, 1879

5) *Dicranolasma scabrum* (HERBST, 1799) (Fig. 3)

Dicranolasma scabrum: GRUBER, 1974: 78 ("Albanien: Paštrik"); STAREGA, 1976a: 68 ("Albanien"); STAREGA, 1976b: 305 ("Albanien").

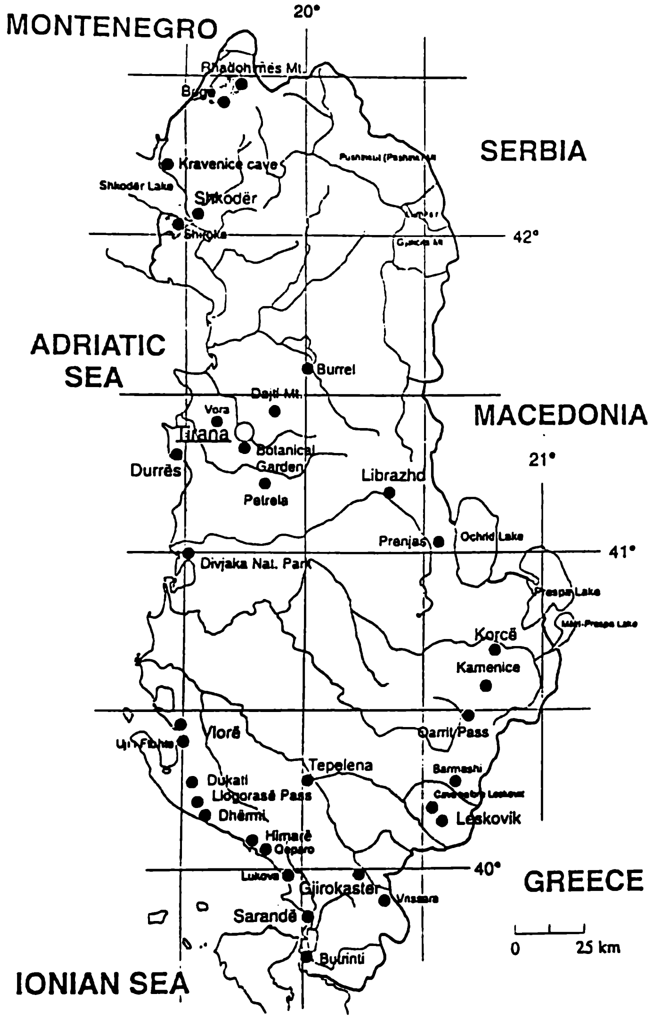

Fig. 1. Map of Albania. Collecting sites of Opiliones (●).

Fig. 2. New records of *Paranemastoma titaniacum* (ROEWER, 1914) (■), *Paranemastoma longipes* (SCHENKEL, 1947) (□), *Mediostoma humerale* (C. L. KOCH, 1839) (○) and *Mitostoma cancellatum* (ROEWER, 1917) (●) in Albania.

Fig. 3. New records of *Dicranolasma scabrum* (HERBST, 1799) (■), *Trogulus tricarinatus* (LINNAEUS, 1758) (○), *Trogulus nepaeformis* (SCOPOLI, 1763) (●) and *Trogulus graecus* DAHL, 1903 (□) in Albania.

Material: Tirana, Kopshti botanik (=Botanical Garden), leaf litter and bark, 08.V.1995, leg. S.G., P.S. and B.P. (11 ♂♂, 3 ♀♀, 5 juv.); Vlorë Distr., near v. Dukati, 450 m a.s.l., leaf litter, 11.V.1995, leg. S.G., P.S. and B.P. (4 juv.).

Distribution: Austria, former Yugoslavia, Hungary, Slovakia, Romania, Bulgaria, Greece (HADŽI 1973; STARĘGA 1976b; MARTENS 1978).

Trogulidae SUNDEVALL, 1833

2

6) *Trogulus tricarinatus* (LINNAEUS, 1758) (Fig. 3)

Trogulus tricarinatus: ROEWER, 1950: 55 ("Albanien: Kula Lums"); STARĘGA, 1976a: 63 ("Albanien"); STARĘGA, 1976b: 298 ("Albanien").

Fig. 4. New records of *Metaphalangium cirtanum* (C. L. Koch, 1839) (■), *Opilio parietinus* (De Geer, 1778) (○), *Opilio saxatilis* C. L. Koch, 1839 (●), *Opilio transversalis* Roewer, 1956 (△), *Metaplatybunus grandissimus* (C. L. Koch, 1839) (□), *Metaplatybunus strigosus* (C. L. Koch, 1848) (×) and *Metaplatybunus carneluttii* Hadži, 1973 (♦) in Albania.

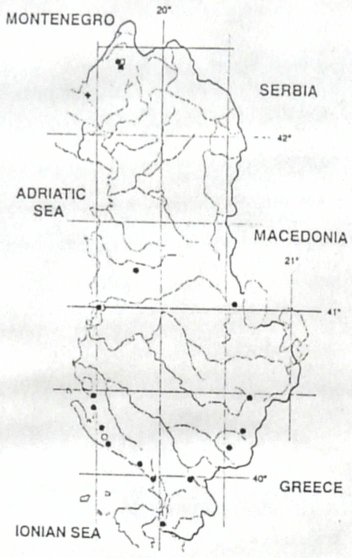

Fig. 5. New records of *Rilaena balcanica* Šilhavý, 1965 (○), *Lacinius horridus* (Panzer, 1794) (●), *Lacinius dentiger* (C. L. Koch, 1848) (□), *Amilenus aurantiacus* (Simon, 1881) (■) and *Nelima troglodytes* Roewer, 1910 (♦) in Albania.

Material: Distr. Shkodër, v. Bogë, Maya Tchardakut Mt., 1400-1600 m a.s.l., Fagetum, 02.VI.1993, leg. P.B. (1 ♂ (5.75 mm): MHNS: No 410). The shape of glans penis closely resembles the drawings in Šilhavý (1956, fig. 205) and Mučalica (1988b, fig. 4a).

Distribution: Widely distributed throughout Europe; also introduced into the USA (Martens, 1978).

7) * *Trogulus nepaeformis* (Scopoli, 1763) (Fig. 3)

Material: Mt. Prokletic, Distr. Shkodër, v. Bogë, 1550 m a.s.l., Fagetum, 23.V.1993, leg. P.B. and B.P. (1 ♂ (8.5 mm): MHNS: No 412). The shape of glans penis closely resembles the drawing in Martens (1978, fig. 269).

Distribution: Widely distributed throughout Europe (Martens, 1978).

8) *Trogulus graecus* Dahl, 1903 (Fig. 3)

Trogulus graecus: Staręga, 1976b: 301 ("Albanien").

Material: Sarandë Distr., Ionian coast, v. Dhërmi, 100 m a.s.l., leaf litter, 11.V.1995, leg. S.G., P.S. and B.P. (1 juv. (9.2 mm)).

Distribution: Bulgaria, Greece, Corfu, European part of Turkey (Staręga, 1976b).

Phalangiidae Simon, 1879

9) *Metaphalangium cirtanum* (C. L. Koch, 1839) (Fig. 4)

Metadasylobus albanicus Schenkel, 1947: 12 (Tirana)(see Staręga, 1973, 1984 for synonymy, but see also Cokendolpher, 1990 and Crawford, 1992).

Metaphalangium cirtanum (C. L. Koch, 1839): Staręga, 1984: 39 ("Albanien").

Material: Tirana, 08.VI.1995, leg. G.B. (1 ♀, 1 juv.); Tirana Distr., near v. Sauku, 02.VI.1992, leg. S.B. (1 ♀, 1 subad.); Tirana Distr., Durrës, Adriatic coast, bunker walls, 24.V.1993, leg. P.S. and D.Z. (2 subad.); Tirana Distr., 2 km N of Durrës, under stones, 24.V.1993, leg. P.S. and D.Z. (1 juv.).

Distribution: The Mediterranean coast (Hadži, 1973b; Martens, 1978; Staręga, 1984; Cokendolpher, 1990; Novak et al., 1995).

10) *Opilio parietinus* (De Geer, 1778) (Fig. 4)

Opilio parietinus De Geer: Kolosváry, 1940: 330 (Albania: "Kula Ljums"); Schenkel, 1947: 14 (Tirana); Roewer, 1956: 294 ("Albanien").

Material: Mt. Prokletic, Distr. Shkodër, v. Bogë, 1000-1100 m a.s.l., 05-09.VI.1993, leg. P.B. and B.P. (1 juv. MHNS: No 399; 4 juv., 1 subad. MHNS: No 408).

Distribution: Widely distributed throughout Europe, W Siberia, Near East, Central Asia, N Anatolia, Caucasus, N (?) Africa; also introduced into the USA, Canada, Tasmania (Martens, 1978; Staręga, 1978, 1984).

11) * *Opilio saxatilis* C. L. Koch, 1839 (Fig. 4)

Material: Shkodër Distr., v. Bogë, 1000-1100 m a.s.l., 05.-09.VI.1993, leg. P.B. and B.P. (8 juv. MHNS: No 402); Tirana Distr., Dajti Mt., 1000 m a.s.l., *Fagus-Acer* forest, under stones, 09.V.1995, leg. S.G., P.S. and B.P. (1 juv.); 3-4 km N Durrës, under stones, 25.V.1993, leg. P.S. and D.Z. (3 juv.); Lushnja Distr., Divjaka National Park, *Pinus halepensis* Mill. and *P. pinea* L. strand forest, under stones, 10.V.1995, leg. S.G., P.S. and B.P. (7 juv.); Vlorë, under stones and soil, 01.V.1994, leg. P.S. and D.Z. (1 juv.); Tepelena, near Drinu river, 03.VI.1995, leg. G.B. (1 ♀, 1 juv.); Vlorë Distr., near Dukati, 450 m a.s.l., leaf littier, 11.V.1995, leg. S.G., P.S. and B.P. (2 juv.); Vlorë Distr., Llogorasë Pass, 1025 m a.s.l., under stones, 11.V.1995, leg. S.G., P.S. and B.P. (1 juv.); Sarandë Distr., Ionian coast, v. Himarë, under stones, 03.-04.V.1994, leg. P.S. (1 juv.); Sarandë Distr., Ionian coast, v. Qeparo, under stones, 04.-05.V.1994, leg. P.S. (1 juv.); Sarandë Distr., Ionian coast, v. Lukova, under stones, 05.V.1994, leg. P.S. and D.Z. (2 ♂♂, 1 ♀, 2 juv.); the same locality, 05.VI.1995, leg. G.B. (1 ♀); Gjirokaster,

the castle, under stones, 06.V.1994, leg. P.S. (4 juv.); Gjirokaster Distr., v. Vrissara, 07.VI.1992, leg. S.B. (1 ♀ (5.0 mm)); Sarandë Distr., Ionian coast, v. Butrinti, 16.IV.1994, leg. S.B. (1 ♀); Ersekë Distr., Leskovik, 650 m a.s.l., 02.VI.1995, leg. G.B. (1 juv.); Ersekë Distr., v. Barmashi, near Langatitsa river, 02.VI.1995, leg. G.B. (2 juv.); Korcë Distr., v. Kamenice, under stones, 07.V.1994, leg. P.S. (1 juv.).

Distribution: Widely distributed throughout Europe and parts of the East Mediterranean coast (MARTENS, 1978).

12) * *Opilio transversalis* ROEWER, 1956 (Fig. 4)

Material: Sarandë Distr., Ionian coast, v. Butrinti, 04.VI.1995, leg. G.B. (1 ♀).

Distribution: Italy, Slovenia, Montenegro, Greece (GRUBER, 1984, 1988).

13) *Metaplatybunus grandissimus* (C. L. KOCH, 1839) (Fig. 4)

Metadasylobus instratus (L. KOCH): KOLOSVÁRY, 1940: 330 (Albania: "Montes Djalica Ljums"); ROEWER, 1956: 269 ("Albanien")(see MARTENS, 1966 for synonymy);

Metaplatybunus grandissimus: MARTENS, 1966: 357 ("Albanien").

Material: Tirana Distr., Dajti Mt., 1000 m a.s.l., *Fagus-Acer* forest, under stones, 09.V.1995, leg. S.G., P.S. and B.P. (1 juv. (5.8 mm)); Vlorë Distr., near v. Dukati, 450 m a.s.l., leaf litter, 11.V.1995, leg. S.G., P.S. and B.P. (1 juv. (5.8 mm)); the same locality, under stones, 11.V.1995, leg. S.G., P.S. and B.P. (2 ♂); Leskovik, 01.VI.1994, leg.?. (1 ♀ (9.1 mm))(with developed eggs and infected with Gregarinnia).

Distribution: Montenegro, Greece, Turkey (ROEWER, 1911, 1923, 1956, 1959; MARTENS, 1966; HADŽI, 1973*b*; RAMBLA, 1976), Georgia (MHEIDZE, 1959, 1964; STARĘGA, 1966).

14) * *Metaplatybunus strigosus* (L. KOCH, 1867) (Fig. 4)

Material: Shkodër Distr., Rhadohimës Mt., 1900-2200 m a.s.l., 28.V.1993, leg. P.B. (1 ♀. MHNS: No 411); Shkodër Distr., v. Bogë, Maya Tchardakut Mt., 1200-1400 m a.s.l., 01.VI.1993, leg. P.B. (1 ♀. MHNS: No 409); the same locality, 1600-1800 m a.s.l., 02.VI.1993, leg. P.B. (2 ♀♀. MHNS: No 401); Shkodër Distr., v. Bogë, 1000 m a.s.l., 03.-04.VI.1993, leg. B.P. (1 ♀); the same locality, 1000-1100 m a.s.l., 05.-09.VI.1993, leg. P.B. and B.P. (1 ♀. MHNS: No 402); the same locality, upper Camp, 1800-1900 m a.s.l., 20.-23.VI.1993, leg. P.B. and B.P. (1 ♂); Shkodër lake, v. Shiroka, 17.IV.1994, leg. S.B. (1 ♂); Ersekë Distr., Leskovik, 02.VI.1995, pitfall traps, leg. G.B. (1 ♀)(with developed eggs).

Distribution: Montenegro, Dalmatia, Macedonia, "Üsküb" (ROEWER, 1923; HADŽI, 1973a,b; KARAMAN, 1995).

15) * *Metaplatybunus carneluttii* HADŽI, 1973 (Fig. 4)

Material: Shkodër Distr., v. Bogë, Maya Tchardakut Mt., 1200-1400 m a.s.l., 01.VI.1993, leg. P.B. (1 juv. MHNS: No 409); Shkodër Distr., v. Bogë, upper Camp, 1800-1900 m a.s.l., 20.-23.VI.1993, leg. P.B. and B.P. (3 juv. MHNS: No 403); Tirana Distr., Dajti Mt., 1000 m a.s.l., *Fagus-Acer* forest, under stones, 09.V.1995, leg.

S.G., P.S. and B.P. (1 juv.); Tirana Distr., v. Petrela, 350 m a.s.l., ruins, shrub, under stones, 09.V.1995, leg. S.G., P.S. and B.P. (1 ♀).

Distribution: Slovenia, Montenegro (MARTENS, 1978; KARAMAN, 1995).

16) * *Rilaena balcanica* ŠILHAVÝ, 1965 (Fig. 5)

Material: Lushnja Distr., Divjaka National Park, *Pinus halepensis* Mill. and *P. pinea* L. strand forest, under stones, 10.V.1995, leg. S.G., P.S. and B.P. (1 ♂); Vlorë Distr., Llogorasë Pass, 1025 m a.s.l., under stones, 11.V.1995, leg. S.G., P.S. and B.P. (1 ♀).

Distribution: Bulgaria, Greece, former Yugoslavia (STARĘGA, 1976b; MUČALICA, 1988a).

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17) *Lacinius horridus* (PANZER, 1794) (Fig. 5)

Lacinius horridus: KOLOSVÁRY, 1940: 330 (Albania: "Montes Djalica Ljums"); MARTENS, 1978: 323 ("Albanien"); STARĘGA, 1976*a*: 129 ("Albanien"); STARĘGA, 1976b: 359 ("Albanien");

Lacinius gallipoliensis ROEWER, 1923: KOLOSVÁRY, 1940: 330 (Albania: "Montes Zljeb, Montes Djalica Ljums"); ROEWER, 1957: 330 ("Albanien: Kula Lums").

Material: Shkodër Distr., v. Bogë, 1000-1100 m a.s.l., 05.-09.VI.1993, leg. P.B. and B.P. (3 juv. MHNS: No 399); Tirana Distr., v. Petrela, 350 m a.s.l., ruins, shrub, under stones, 09.V.1995, leg. S.G., P.S. and B.P. (1 juv.); Lushnja Distr., Divjaka National Park, *Pinus halepensis* Mill. and *P. pinea* L. strand forest, under stones, 10.V.1995, leg. S.G., P.S. and B.P. (1 juv.); Vlorë, under stones and soil, 01.V.1994, leg. P.S. and D.Z. (8 juv.); Vlorë Distr., Ionian coast, near Uji i Ftohte, 01.V.1994, leg. G.B. (1 juv.); Vlorë Distr., near Dukati, 450 m a.s.l., leaf littier, 11.V.1995, leg. S.G., P.S. and B.P. (2 juv.); Sarandë Distr., Ionian coast, v. Dhërmi, under stones, 02.V.1994, leg. P.S. (4 juv.); Sarandë Distr., Ionian coast, v. Qeparo, under stones, 04.-05.V.1994, leg. P.S. (1 juv.); Sarandë Distr., Ionian coast, v. Lukove, under stones, 05.V.1994, leg. P.S. and D.Z. (6 juv.); Sarandë Distr., Ionian coast, v. Butrinti, 04.VI.1995, leg. G.B. (1 juv.); Gjirokaster, the castle, under stones, 06.V.1994, leg. P.S. (3 juv.); 5 km before Leskovik, 01.VI.1994, leg. P.T. (1 juv.); Ersekë Distr., Leskovik-v. Barmashi, near Langatitsa river, 02.VI.1995, leg. G.B. (2 juv.); Korcë Distr., Qarrit Pass, "passage Q. e. Qavvit", 01.VI.1994, leg. T.I. (1 juv.); Librazhd Distr., above v. Prenjas, 750 m a.s.l., shrub on slope, 07.V.1995, leg. S.G., P.S. and B.P. (7 juv.).

Distribution: Widely distributed throughout Europe (MARTENS, 1978).

Note: STARĘGA (1976b) synonymized *Lacinius gallipoliensis* ROEWER, 1923 with *L. horridus* (PANZER, 1794).

18) * *Lacinius dentiger* (C. L. KOCH, 1848) (Fig. 5)

Material: Shkodër Distr., v. Bogë, 1000-1100 m a.s.l., 05.-09.VI.1993, leg. P.B. and B.P. (9 juv. MHNS: No 399; 1 juv. MHNS: No 402.).

Distribution: Widely distributed throughout Europe (MARTENS, 1978).

19) * *Amilenus aurantiacus* (SIMON, 1881) (Fig. 5)

Material: Shkodër Distr., v. Bogë, Maya Tchardakut Mt., 1200-1400 m a.s.l., 01.VI.1993, leg. P.B. (2 ♂♂, MHNS: No 409); the same locality, 1600-1800 m a.s.l., 02.VI.1993, leg. P.B. (2 ♂♂, MHNS: No 401).

Distribution: France, Germany, Italy, Switzerland, Austria, Slovakia (?), Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Macedonia, Bulgaria, Greece: Corfu (HADŽI, 1973b; STARĘGA, 1976b; MARTENS, 1969, 1978).

20) *Nelima troglodytes* ROEWER, 1910 (Fig. 5)

Nelima troglodytes ROEWER, 1910: ROEWER, 1923: 914 ("Albanien"); KRATOCHVIL, 1946: 175 ("od Splitu do Albánie"); KARAMAN, 1995: 62 ("Albanije").

Material: Shkodër Distr., v. Daiç, 100 m in the Kravenice cave, 05.VI.1992, leg. S.B. (2 ♀♀, 6 juv.); the same locality, 06.VI.1992, leg. S.B. (2 ♂♂, 4 ♀♀, 2 juv.).

Distribution: Croatia (Dalmatia), Bosnia, S Herzegovina, Montenegro (HADŽI, 1973b).

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ELECTRORETINOGRAPHIC MODULATION BY DOPAMINE AND NORADRENALINE IN THE SPIDER *LYCOSA TARENTULA* (ARANEAE: LYCOSIDAE)

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Abstract

MUÑOZ-CUEVAS A., CARRICABURU P.: Electroretinographic modulation by dopamine and noradrenaline in the spider *Lycosa tarentula* (Araneae: Lycosidae). In GAJDOŠ P., PEKÁR S. (eds): Proceedings of the 18th European Colloquium of Arachnology, Stará Lesná, 1999. Ekológia (Bratislava), Vol. 19, Supplement 3/2000, p. 171-180.

Injections of dopamine, or noradrenaline, produced modifications of the amplitude, latency and profile of the electroretinograms (ERGs) in a lycosid spider. Each type of eye showed its own ERG modifications. Dopamine-treated anterior-median and lateral eyes showed opposite modifications of the amplitudes of ERGs which increased (AME) or decreased (ALE) compared with controls; the latencies were increased in both cases. Dopamine induced a significant decrease of the amplitudes and an increase of the latencies of ERGs of posterior-median (PM) and lateral (PL) eyes. The effect of noradrenaline was less marked. The antagonist haloperidol produced an opposite effect on ERGs of ALE for all dark adaptation times. The study of visual neuromodulation opens a way towards the control of visually-guided behaviours such as predation, sexual display and orientation in *Lycosa tarentula*.

Introduction

Catecholamines are well known as neuromodulators and neurotransmitters in vertebrates. Dopamine, mainly, has been widely studied in relation to the modulation of vertebrate visual systems (review by NGUYEN-LEGROS, 1996).

The action of cataecholamines on arthropod visual system has very rarely been studied. KONOPKA (1972) observed very low concentrations of dopamine in mutants *tan* of *Drosophila melanogaster* which showed striking abnormalities of their electroretinograms (HOTTA, BENZER, 1969). Noradrenaline plays a role in screening pigment regulation of a sphingid moth, *Deilephila elpenor* (JUSE et al., 1987). Most studies of this kind on neuromodulation

The millipedes of Albania: recent data, new taxa; systematical, nomenclatural and faunistical review (Myriapoda, Diplopoda)

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ABSTRACT
A recent collection of Diplopoda deriving from Albania contains thirty-two identifiable species, including four new to science: *Acanthopetalum subpatens* n.sp. (Schizopetalidae), *Anamastigona albanensis* n.sp. (Anthroleucosomatidae), *Metonomastus petrelensis* n.sp. (Paradoxosomatidae) and *Typhloiulus beroni* n.sp. (Julidae). The millipede fauna of Albania and adjacent lands is reviewed, with a checklist currently encompassing fifty genera and over 150 species or subspecies. Some new synonymies are established concerning: *Glomeris pustulata* Latreille, 1804; *Acanthopetalum carinatum* (Brandt, 1840); *Brachyiulus varibolinus* Attems, 1904; *Acanthoiulus fuscipes* (C. L. Koch, 1847); *P. varius* (Fabricius, 1781); *Leptoiulus sarajevensis* Verhoeff, 1898; *Leptoiulus* Verhoeff, 1894. A substitute name is proposed for *Leptoiulus storkani* Verhoeff, 1932: *L. jaroslavi* nom. nov. The julid tribe Typhloiulini is synonymized under the Leptoiulini. The name *Diploiulus* Berlese, 1883, is considered to have been typified in the original description, with *Julus terrestris* Linnaeus, 1758, being its valid type species; *Diploiulus* becomes objective synonym of *Julus* Linnaeus, 1758, and *Acanthoiulus* Verhoeff, 1896, takes priority in the list of synonyms or subgenera of *Pachyiulus*. *Pachyiulus krivolutskyi* Golovatch, 1977, is a new subjective junior synonym of *Iulus foetidissimus* Muralewicz, 1907, non *Iulus foetidissimus* Savi, 1819, it is available as a replacement name to avoid homonymy. The following taxa are new from Albania: *Glomeris pustulata* Latreille, 1804; *Acanthopetalum albidicolle* Verhoeff, 1900; *Brachydesmus herzogowinensis* Verhoeff, 1897; *Leptoiulus macedonicus* (Attems, 1927); *Brachyiulus apfelbeckii* Verhoeff, 1898; *Megaphyllum imbecillum* (Latzel, 1884); *Metonomastus* Attems, 1937 and *Anamastigona* Silvestri, 1898.

KEY WORDS
Diplopoda,
fauna,
taxonomy,
Albania.

RÉSUMÉ
Une importante collection de diplopodes récoltée récemment sur une grande partie du territoire de l'Albanie est étudiée ici ; elle comprend trente-deux espèces dont quatre sont nouvelles pour la Science : *Acanthopetalum subpatens* n.sp. (Schizopetalidae), *Anamastigona albanensis* n.sp. (Anthroleucosomatidae), *Metonomastus petrelensis* n.sp. (Paradoxosomatidae), *Typhloiulus beroni* n.sp. (Julidae). Une liste des diplopodes de l'Albanie et des régions voisines est donnée ; elle comprend huit ordres, au moins dix-neuf familles, cinquante genres et plus de 150 espèces ou sous-espèces d'une validité indiscutable. Plusieurs nouvelles synonymies ont pu être établies : *Glomeris pustulata* Latreille, 1804 = *Gl. norica vodnatensis* Verhoeff, 1926 ; *Acanthopetalum carinatum* (Brandt, 1840) = *Lysiopetalum comma* Verhoeff, 1900, *L. thessalorum* Verhoeff, 1901, *L. macedonicum* Verhoeff, 1923, *L. albanicum* Verhoeff, 1932, *L. comma janinense* Verhoeff, 1932, *L. thessalorum lychnitis* Verhoeff, 1932 ; *Brachyiulus varibolinus* Attems, 1904 = *B. beratinus* Manfredi, 1945 ; *Acanthoiulus fuscipes* (C. L. Koch, 1847) = *Pachyiulus bosniensis* Verhoeff, 1895, *P. fuscipes altivagus* Verhoeff, 1899, *P. f. plasensis* Verhoeff, 1910, *P. f. simplex* Verhoeff, 1910 ; *Pachyiulus varius* (Fabricius, 1781) = *Julus flavipes* C. L. Koch, 1847, *Iulus oenologus* Berlese, 1885, *Pachyiulus apfelbecki* Verhoeff, 1901, *P. varius* var. *pallipes* Manfredi, 1945 ; *Leptoiulus sarajevensis* Verhoeff, 1898 = *Macedoiulus storkani* Verhoeff, 1932. Un nouveau nom, *Leptoiulus jaroslavi*, est proposé en remplacement de *Leptoiulus storkani* Verhoeff, 1932, pour corriger l'homonymie résultant de la synonymie de *Leptoiulus* Verhoeff, 1894 et *Macedoiulus* Verhoeff, 1932. La tribu des Typhloiulini disparaît, englobée par les Leptoiulini. Le taxon nominal *Diploiulus* Berlese, 1883 est considéré ici comme validé dans la description originale par la désignation de *Julus terrestris* Linnaeus, 1758, comme espèce-type ; de ce fait, *Diploiulus* devient un synonyme objectif de *Julus* Linnaeus, 1758, et en conséquence *Acanthoiulus* Verhoeff, 1896, devient prioritaire dans la liste des synonymes ou sous-genres de *Pachyiulus* Berlese, 1883. *Pachyiulus krivolutskyi* Golovatch, 1977, du Caucase occidental, qui est un nouveau synonyme subjectif plus récent de *Iulus foetidissimus* Muralewicz, 1907, remplace ce taxon pour éviter l'homonymie avec *Iulus foetidissimus* Savi, 1819. Les genres *Metonomastus* Attems, 1937, et *Anamastigona* Silvestri, 1898, sont répertoriés pour la première fois d'Albanie, ainsi que les espèces suivantes : *Glomeris pustulata* Latreille, 1804 ; *Acanthopetalum albidicolle* Verhoeff, 1900 ; *Brachydesmus herzogowinensis* Verhoeff, 1897 ; *Leptoiulus macedonicus* (Attems, 1927) ; *Brachyiulus apfelbeckii* Verhoeff, 1898 ; *Megaphyllum imbecillum* (Latzel, 1884).

MOTS CLÉS
Diplopoda, faune, taxinomie, Albanie.

INTRODUCTION

The diplopod fauna of the Balkan Peninsula, including Albania, has long been acknowledged as one of the richest in the Mediterranean, indeed in the Palaearctic as a whole. Even the incomplete, poor but recent work by Ceuca (1992), devoted to this fauna, lists 140 genera and over 660 species or subspecies, of which twenty genera and fifty-three species (including nine endemics) have been recorded in Albania.
The present contribution is mainly devoted to the study of a fine collection of Diplopoda recently made in Albania by Dr. P. Beron,

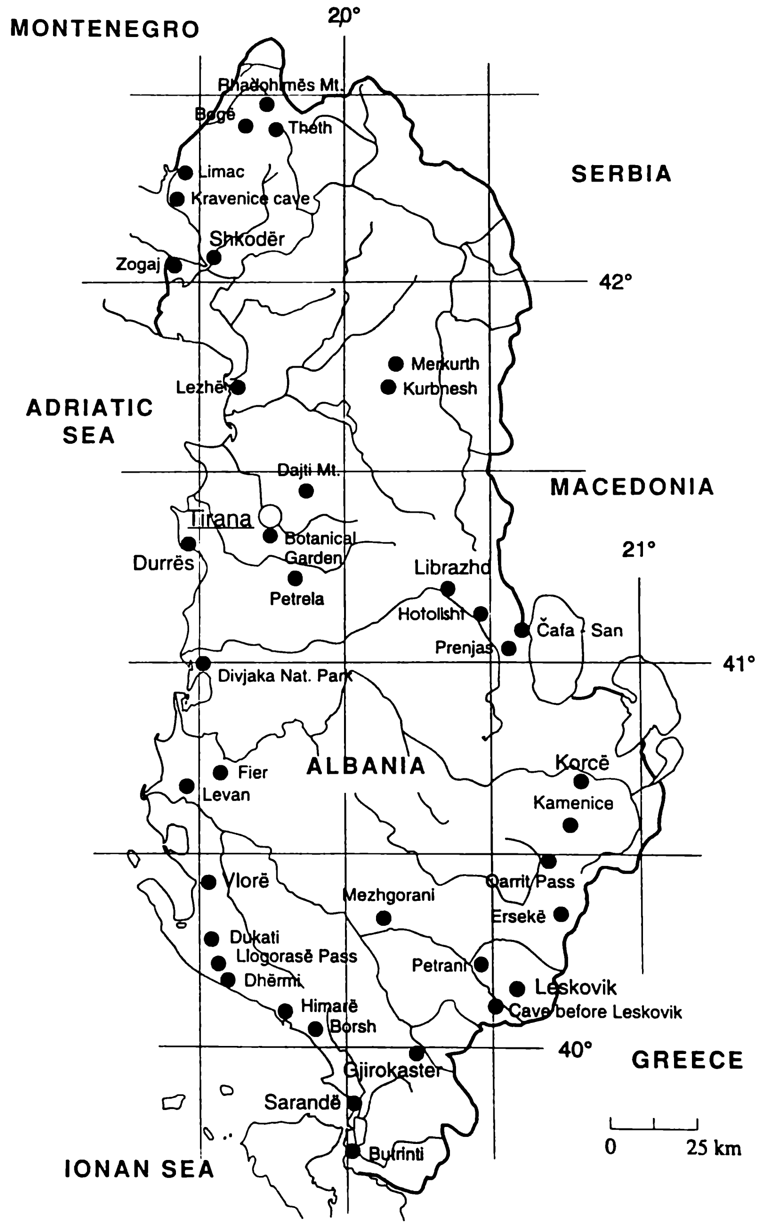


FIG. 1. — Map of Albania. Dark spots represent the localities visited by recent collectors (almost all from Sofia, Bulgaria) since 1993 in numerous parts of the territory of Albania.

red pygidium appear stable, though pygidial punctuation is known to be missing in *h. herzogowinensis* (see Attems 1935).

The structure of the male legs 17 to 19 is also quite variable, *e.g.* the armature of tarsus 17 with spines and the outline of the external lobe of coxa 17 (though the latter is always low and inconspicuous) (Fig. 2A). The notch of syncoxite 18 ranges from broad (Fig. 2B) to very broad, sometimes even with a median knob. The median lobe of syncoxite 19 is more or less high and usually somewhat truncated (Fig. 2C), the inner femoral process is more or less prominent (Figs 2C, D).

The male from Himarë deserves special mention. Superficially, it represents an unquestioned *herzogowinensis*, yet its legpair 18 looks quite bizarre due to a conspicuous inner femoral process which strongly resembles that of the telopod proper (Fig. 2F). Both legpairs 17 and 19 look normal (Figs 2E, G). However, a closer examination of this specimen showed that its pygidium is abnormal, with an evident asymmetrical notch at the caudal margin. Moreover, the femoral processes on legpair 18 appear somewhat unequal, one of them being bifid. The median lobe of the telopod syncoxite is also slightly asymmetrical.

The coherent distribution pattern, the presence of only a single male exhibiting such a peculiar structure of legpair 18 (comparable among the Glomerida perhaps only with that of the Glomeridellidae) and, especially, the likely teratology, all this precludes us from creating a separate species for this specimen, regardless of its distinctive appearance.

Glomeris pulchra C. L. Koch, 1847

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1300 m, Maya Bridashit, 20.V.1993, 4 ♂♂, 5 ♀♀ (NHMS), 1 ♂, 1 ♀ (MNHN, Collection Myriapodes CC 095), 2 ♂♂, 1 ♀ (ZMUM), leg. P. Beron & B. Petrov. — Zogaj, artificial gallery, 13.IV.1994, 2 ♂♂, 1 ♀ (NHMS), leg. S. Beshkov.

REMARKS

All these samples display a colour pattern typical for the species concerned, with a pair of pale spots also on terga 5 to 7. This species (which includes numerous varieties - *e.g.* Attems 1929) has already been reported from Albania and the adjacent Balkan regions.

Glomeris pustulata Latreille, 1804

Glomeris norica vodnatensis (Verhoeff, 1926), syn. n.

MATERIAL EXAMINED. — **Rhëshen District.** Merkurth, under stones, 11.VI.1993, 1 ♂ (NHMS), leg. P. Beron & B. Petrov.

REMARKS

The identities both of the above sample and the name *vodnatensis* itself are quite obscure. The latter was introduced as based on a single holotype male from Wodnata Peschtera Cave, in the Tzerovo area (Isker-Defile), N Bulgaria. It was initially described as a variety of *Glomeris norica* Latzel, 1884, a species which in turn was originally established as only a variety of *pustulata*! Verhoeff (1926) also mentioned another male taken from the same cave together with the holotype of *vodnatensis*, which he referred to as an "almost typical" *norica*. *G. n. vodnatensis* was said to differ by the body being entirely black, with traces of pale spots on the thoracic shield, pygidium and tergum 7, as well as by the thoracic shield bearing 1 + 2 striae. This strict syntopy alone casts doubt on the validity of *vodnatensis*, which perhaps explains why Verhoeff treated it as only a variety.

Yet Strasser (1966) promoted *vodnatensis* to full species status and even regarded the Bulgarian *G. pustulata diminuta* Attems, 1951, as its junior synonym. Latzel (1884) characterized his var. *norica* as differing from *pustulata* by the often considerably larger transverse-oval tergal spots, two crossing striae on the thoracic shield and a small but evident tubercle on the pygidium of both sexes. This knob is sometimes known to be absent from *pustulata*, its presence being more characteristic of *norica* (see Latzel, 1884).

The Albanian specimen at hand displays a somewhat elevated number of striae on the thoracic shield: 1 very small anterior + 1 complete + 3 incomplete posterior. Also, it has small reddish spots on all terga, a well-expressed caudal concavity but no tubercule on the pygidium. Yet considering the quite pronounced variation range in the size, colour and presence of pale spots on certain terga as well as in the number of striae on the thoracic shield, the presence of a knob on the pygidium, etc. (Latzel 1884; Attems

1959), coupled with the vast distribution of *pustulata*, ranging from NW Africa, the Iberian Peninsula and France in the west to the Balkans, Alps and Carpathians (with the adjacent plains of Germany, Poland, Hungary and Rumania) in the east, it seems better to attribute the above male to *pustulata*. In addition, this species has already been recorded in nearby Croatia and Slovenia, as well as in Bulgaria thus being new to the Albanian list.

Order CALLIPODIDA Bollman, 1893
Family DORYPETALIDAE Verhoeff, 1900

Dorypetalum trispiculigerum Verhoeff, 1900

MATERIAL EXAMINED. — **Sarandë District.** Ionian Coast, Borsh, under stones, 5.V.1994, 1 ♂, 1 juv. ♀ (NHMS); leg. P. Stoev.

REMARKS

Described from Corfu (= Kyrkera) by Verhoeff (1900) as a subspecies of *degenerans* (Latzel, 1884), the nominate form of which is currently known from Bosnia and Hercegovina, Serbia, Macedonia, and Rumania, *D. trispiculigerum* has since become treated as a separate species restricted to Corfu and Epirus, NW Greece (Strasser 1976). Moreover, Strasser (1976) noted certain variability in its gonopod structure, so the question arises as to whether this taxon is a junior synonym of the Bosnian *degenerans bosniense* (Verhoeff, 1897). A direct comparison of the types is thus desirable to solve this question. Our sample from Borsh, some 30 km from the terra typica, agrees very well with the original description and represents the first formal record of *trispiculigerum* in Albania.

Family SCHIZOPETALIDAE Verhoeff, 1909

Callipodella fasciata (Latzel, 1882)
(Fig. 3A, B)

MATERIAL EXAMINED. — **Shkodër District.** Theth, 800-900 m, 28.V.1993, 2 ♂♂, 2 ♀♀ (NHMS), leg. P. Beron (No. 556). — Bogë, 1000-1100 m, 5-9.VI.1993, 1 ♂, 1 ♀ (ZMUM), leg. P. Beron & B. Petrov. — Bogë, Maya Tchardakut, 1200-1400 m, 1.VI.1993, 1 ♀ (NHMS), leg. P. Beron (No. 573). — Same locality, 1400-1800 m, 1.VI.1993, 1 ♀, 1 juv. ♀ (NHMS), leg. P. Beron (No. 562).

REMARKS

This Balkan (*s.l.*) species has already been reported from Albania (Attems 1929, 1959). New illustrations are presented here to depict its highly characteristic gonopod structure (Figs 3A, B).

Apfelbeckia wohlberedti Verhoeff, 1909
(Fig. 3C-E)

MATERIAL EXAMINED. — **Shkodër District.** Bogë, cave No. 25, 23.V.1993, 1 ♂, 2 ♀♀ (NHMS), leg. P. Beron & B. Petrov (No. 555). — Hot region, Daic, Cave Kravenices, 12.XI.1991, 1 ♀, 1 juv. (NHMS), leg. N. Lanjev. — Same locality, 5.VI.1992, 4 ♂♂ (NHMS), leg. S. Beshkov. — Hot region, near Shkodër, Limac, cave, 100 m, 4.VI.1992, 4 ♂♂ (NHMS), leg. S. Beshkov. — Same locality, 6.VI.1992, 1 ♂ (NHMS), leg. S. Beshkov. — Zogaj, artificial gallery, 13.IV.1994, 1 ♂, 1 ♀ (NHMS), 1 ♂, 1 ♀ (MNHN, Collection Myriapodes F 040), 1 ♂, 1 ♀ (ZMUM), leg. S. Beshkov.

REMARKS

This very large species has hitherto been reported only from the north of Albania. Because the original illustrations presented by Verhoeff (1909) show only separate details of gonopod structure, new drawings have been made from a typotype to display an entire gonopod (Fig. 3C-E). Like the type series taken at Reçi, most of the new specimens are from caves, though the general appearance of the creature is definitely trogloxenic: it is darkly pigmented and with fully developed, black ocellaria.

Acanthopetalum (*Acanthopelum*) *albidicolle* (Verhoeff, 1900)

MATERIAL EXAMINED. — **Sarandë District.** Ionian coast, Himarë, cave, middle part, 4.V.1994, 2 ♀♀, several juv. (NHMS), leg. P. Stoev.

REMARKS

Even with only male at hand, this species is easy to recognize, due to its characteristically pale col-

Dr. S. Beshkov, Miss T. Ivanova, Mr. N. Lanjev, Mr. B. Petrov, Mr. P. Tenchev, Mr. T. Troanski and Miss D. Zaprianova (all from Sofia, Bulgaria) as well as by two of us (P. Stoev and S. Golovatch). This collection covers much of the territory of this country (see Fig. 1) and happens to contain a number of taxa new either to science or to the Albanian list. In addition, several samples have allowed us to shed additional light on the status of some older taxa, resulting in some new synonymies.

All this has made it possible to review the entire diplopod fauna of Albania and adjacent areas and to compile a new checklist. As such a presentation does not lend itself to a separate historical treatment, all relevant references are given in the text and/or mentioned in the checklist.

The bulk of the material treated here, including all holotypes, have been deposited in the collection of the National Museum of Natural History in Sofia, Bulgaria (NHMS), with a few samples being retained for the Muséum national d'Histoire naturelle in Paris, France (MNHN), and the Zoological Museum of the State University of Moscow, Russia (ZMUM), as indicated hereafter.

TAXONOMIC PART

Order POLYXENIDA Lucas, 1840
Family POLYXENIDAE LUCAS, 1840

Polyxenus lagurus (Linnaeus, 1758)

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1550 m, 23.V.1993, 4 juv. (NHMS), leg. P. Beron & B. Petrov.

Lushnja District. Divjaka Natural Park, *Pinus halepensis* and *P. pinea* strand forest, under stones, 10.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

This trans-holarctic species has long been reported from Albania (Attems 1929). The samples at hand seem to belong to the bisexual race (M. Nguyen Duy-Jacquemin, personal communication).

Order GLOMERIDA Leach, 1815
Family GLOMERIDAE Leach, 1815

Onychoglomeris herzogowinensis (Verhoeff, 1898) (Fig. 2A-G)

MATERIAL EXAMINED. — **Sarandë District.** Ionian Coast, Dhërmi, 16.IV.1994, 1 ♀ (NHMS), leg. S. Beshkov. — Between Dhërmi and Himarë, under stones, 3.V.1994, 2 ♂♂, 1 ♀ (NHMS); 2 ♂♂, 2 ♀♀ (ZMUM), leg. P. Stoev. — Himarë, 3-4.V.1994, 1 ♂ (NHMS), leg. P. Stoev.

Vlorë District. Near Dukati, 450 m, leaf litter and under stones, 11.V.1995, 2 ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Llogorasë Pass, S of Vlorë, 1025 m, under stones, 11.V.1995, 2 ♂♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

Gjirokaster District. Gjirokaster, castle, under stones, 6.V.1994, 2 ♂♂, 3 ♀♀ (NHMS); 2 ♂♂, 2 ♀♀ (MNHN, Collection Myriapodes CC 068), leg. P. Stoev.

REMARKS

The species name has been misspelt since its original proposal (see history in Attems 1935, sub *hercegovinensis*). This species has been split into three subspecies: *O. h. herzogowinensis* (Verhoeff, 1898), from Croatia, Bosnia, Hercegovina and Montenegro, *O. h. media* Attems, 1935, from Albania, and *O. h. australis* Attems, 1935, from Epirus, Greece (Attems 1935). The abundant material at hand permits us, however, to question this division and we refer to *herzogowinensis* as a single, quite widespread and rather variable W Balkan species.

Indeed, size variations range from 13-24 mm in length and from 7-11 mm in width, with female typically somewhat larger than male. Coloration of the terga is usually blackish (regardless of the usual pale lateral and caudal margins), only very seldom pale red-yellowish-brown, with faint marbled markings sometimes visible in places, mostly antero-sublaterally on each tergite to only a very few postcollar terga. The thoracic shield is crossed by 1-2 striae. The male pygidium is usually distinctly concave/impressed transversely, though in one male from Gjirokaster it is almost as convex as in the female. On the other hand, such characters as the single stria across the collum as well as the delicately and densely punctu-

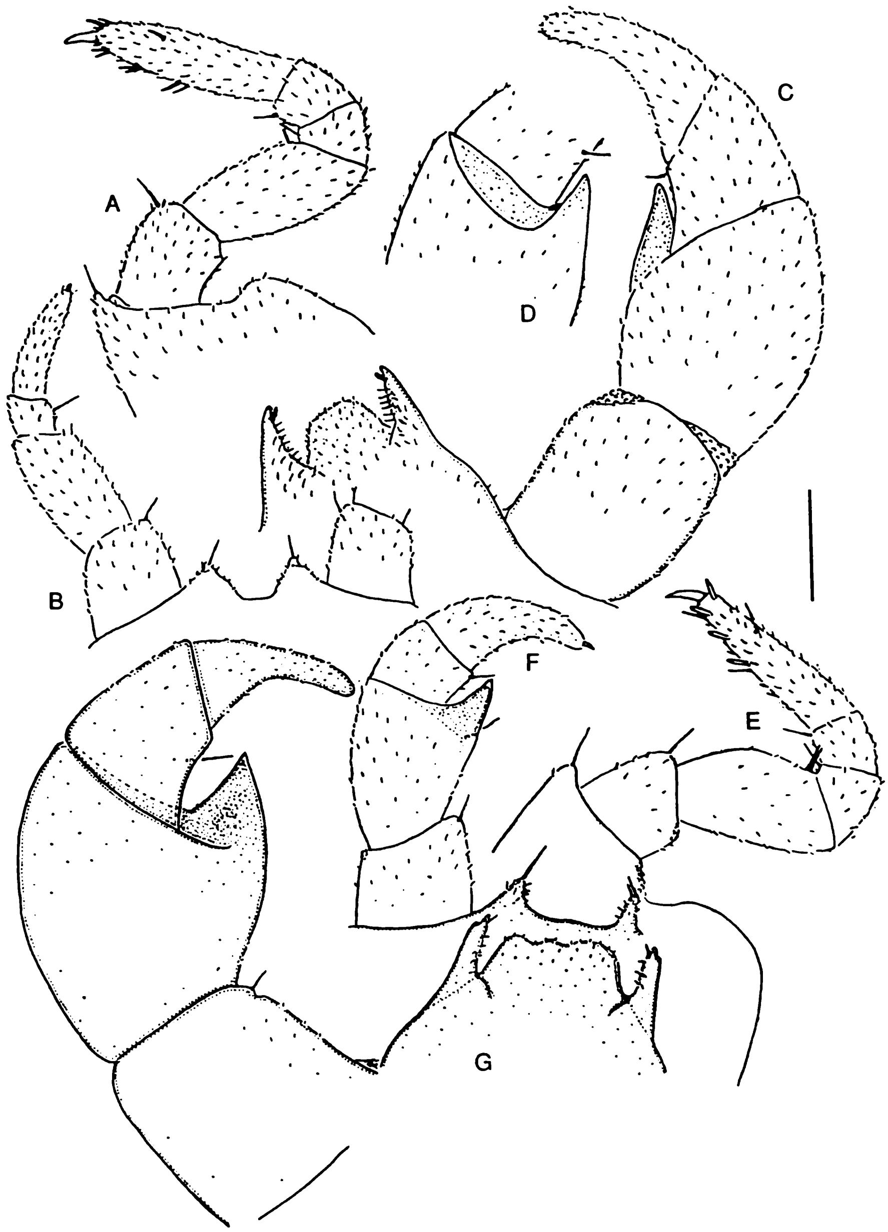


FIG. 2. — *Onychoglomeris herzogowinensis* (Verhoeff, 1898), ♂♂ from Dhërmi-Himarë (A-D) and Himarë (E-G): **A**, **E**, leg 17; **B**, **F**, leg 18; **C**, **G**, leg 19 (telopods), frontal view; **D**, femoral process of telopod, caudal view. Scale bar: 0.5 mm.

lum contrasting with the remaining dark body (Verhoeff 1900; Strasser 1970). Hitherto known only from Corfu, Greece, only some 40 km away from Himarë, this represents the first definite record of *albidicolle* in Albania. Strasser (1976) also reported it from Albania, but without mentioning any relevant material.

Acanthopetalum (*Petalysium*) *carinatum* (Brandt, 1840) (Fig. 3F-J)

Lysiopetalum comma Verhoeff, 1900, syn. n.
Lysiopetalum thessalorum Verhoeff, 1901, syn. n.
Lysiopetalum macedonicum Verhoeff, 1923, syn. n.
Lysiopetalum albanicum Verhoeff, 1932, syn. n.
Lysiopetalum comma janinense Verhoeff, 1932, syn. n.
Lysiopetalum thessalorum lychnitis Verhoeff, 1932, syn. n.

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1000-1100 m, 8-9.VI.1993, 1 ♀, 1 juv. ♀ (NHMS), leg. P. Beron & B. Petrov. — Same locality, Maya Tchardakut, 1400-1600 m, 1.VI.1993, 1 ♂ (NHMS), leg. P. Beron. — Theth, 800-900 m, 28.V.1993, 2 ♂♂ (NHMS), leg. P. Beron (No. 556).
Lushnja District. Divjaka Natural Park, *Pinus halepensis* and *P. pinea* strand forest, 10.V.1995, 2 ♂♂, 2 ♀♀, 4 juv. ♀♀, 1 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Rrëshen District. Merkurth, under stones, 11.VI.1993, 1 ♂ (ZMUM), leg. P. Beron & B. Petrov.
Vlorë District. Near Dukati, 450 m, under stones, 11.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Llogorasë Pass, S of Vlorë, 1025 m, strongly deteriorated *Pinus* stand, under stones, 11.V.1995, 1 ♀, 2 juv. ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Sarandë District. Ionian coast, Dhërmi, 2.V.1994, 1 ♂, 3 juv. ♀♀, 3 juv. (MNHN, Collection Myriapodes F 006), leg. P. Stoev. — Same locality, dry small cavern, 2-20 m in length, 3.V.1994, 2 ♀♀ (NHMS), leg. P. Stoev. — Between Dhërmi & Himarë, under stones, 30.V.1994, 1 ♀ (NHMS), leg. P. Stoev.
Gjirokaster District. Gjirokaster, castle, 6.V.1994, 1 ♂, 1 juv. ♀, 2 juv. (NHMS), leg. P. Stoev.
Korçë District. Pustec (Liqena), artificial gallery, 5.X.1994, 1 ♀, 1 juv. (NHMS), leg. P. Beron. — Same locality, Cave Gubilishteto (Sinkhole), 6.X.1994, 1 juv. ♀ (NHMS), leg. P. Beron & T. Ivanova. — Pustec 1 (Maligrad), 5.XI.1994, 1 ♀ (NHMS), leg. T. Ivanova. — Tren, Uikut Cave, 3.X.1994, 1 ♀, 5 juv. ♀ (NHMS), leg. P. Beron & T. Ivanova. — Lake Prespa, Maligradska peshtera Cave, 5.X.1994, 1 ♂ (NHMS), leg. P. Beron & T. Ivanova.
Tirana District. Tirana, Botanical Gardens, under stones, 8.V.1995, 1 ♂, 1 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Mt. Dajti, 20 km NE of Tirana, 1000 m, *Fagus, Acer*, etc. forest, leaf litter, 9.V.1995, 1 ♂, 1 ♀, 1 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Librazhd District. Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Permet District. Petrani, complex of artificial galleries, 300 m, 12.V.1995, 1 ♂ (NHMS), leg. P. Stoev & B. Petrov.

REMARKS
The taxa listed in the synonymy have hitherto been referred to either as the *carinatum*-group (*cf.* Hoffman 1972) or as *Petalysium* Strasser, 1976, the latter as an independent subgenus as opposed to the remaining *Acanthopetalum* s. str. (see Strasser 1974; designation of *carinatum* as the type species in Strasser 1976). Characterized first of all by the presence of a peculiar process (U in Fig. 3F-J) on the gonopod femorite, this group seems fairly homogeneous and is also easily distinguished by the gonocoxal processes crossing each other *in situ*, the gonopod prefemur and femur combined being much longer than the acropodite, and the sternal triangles between the male legpairs 8 and 9 strongly swollen (*cf.* Strasser 1974). Yet, this group has been plagued by nomenclatural problems ever since the description of *Lysiopetalum carinatum*.
Brandt (1840) described his *carinatum* very poorly from some unspecified material from Dalmatia. Later, Latzel (1884) provided not only a fine catalogue, a fine redescription and proper illustrations of gonopod morphology, based on topotypes, but he even indicated the exact provenance of Brandt's type samples. Verhoeff (1923) also studied a good number of additional topotypes (some of which, all females, are housed in the MNHN collection), providing further illustrations of gonopod structure and comparing it with those of some especially closely related taxa. As a result, the identity of *carinatum* can be considered as fixed with a fair degree of certainty. What strikes one immediately, when studying and comparing the relevant literature and drawings, is the fact that all above Verhoeffian taxa differ vir-

tually solely in the degree of expression of the gonofemoral uncus (U). In *albanicum* and *thessalorum*, U is almost straight, while in *carinatum*, *macedonicum* and, especially, *comma* it is strongly unciform (*cf.* Verhoeff 1932, sub *oncos*). At first, even Verhoeff (1899, 1909) lumped all his samples deriving from Bosnia, Hercegovina, Dalmatia and Albania under *carinatum*, as did

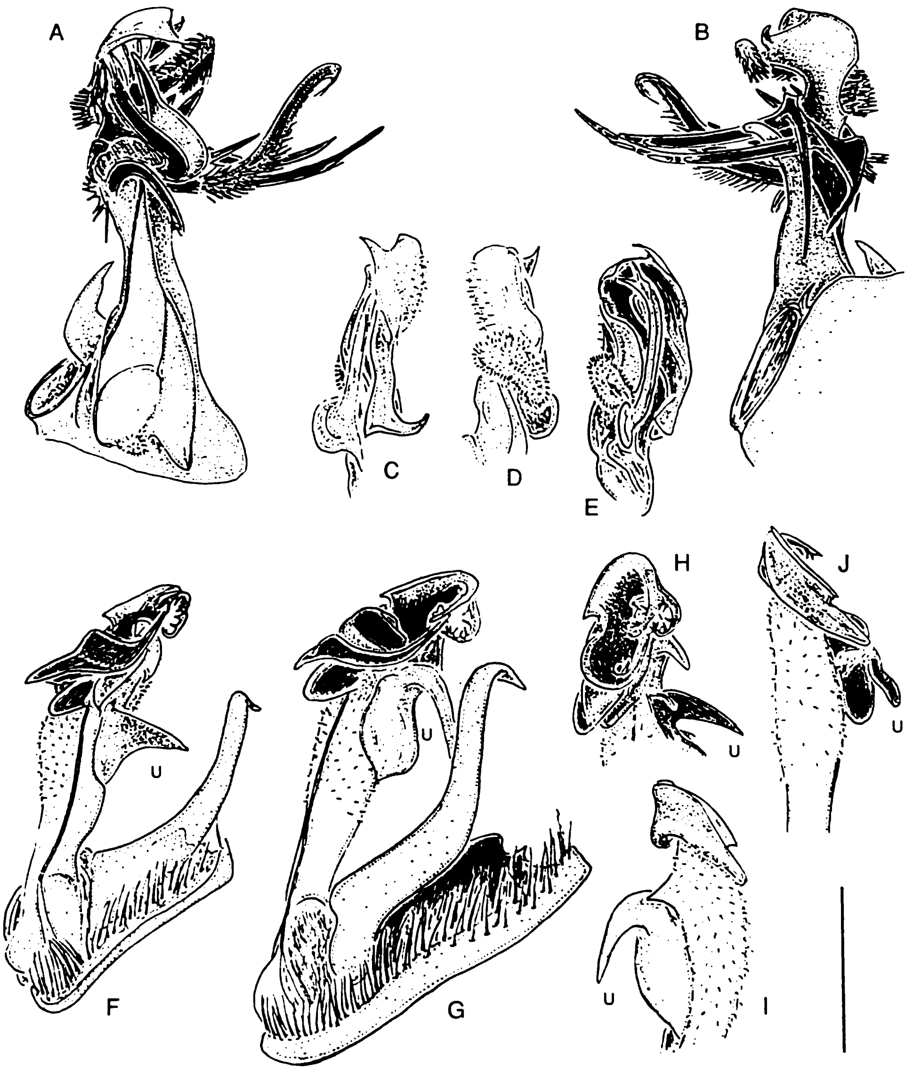


FIG. 3. — Gonopods of *Callipodella fasciata* (Latzel, 1882), ♂ from Theth (A-B); *Apfelbeckia wohlberedti* Verhoeff, 1909, ♂ from near Bogë (C-E), and *Acanthopetalum carinatum* (Brandt, 1840), ♂♂ from Merkurth (F, mesal view) and Dhërmi (G-J, various aspects). Scale bar: 1.0 mm (A, B, F-J) and 2.0 mm (C-E).

Manfredi (1945) for her few Albanian specimens of *Acanthopetalum* (also sub *Lysiopetalum*). Having revised most of the relevant types, Hoffman (1972) questioned the status of *albanicum*, thinking it might even represent the same population as *lychnitis*, stressing that both taxa scarcely differ from *thessalorum*. Besides, Strasser (1976) suggested that *janinense* would be better regarded as a variety, rather than as a subspecies of *comma*.

All available evidence, including the material at hand, leads to the conclusion that we in fact face only a single variable species, *carinatum* by priority. Hence the above new synonyms. Variations mainly concern body size and, especially, the shape of U, the latter ranging from relatively small and straight (*e.g.* var. *albanicum*) to particularly large and strongly curved (var. *comma*). Figure 3F-J shows almost the entire known variation range of U shapes.

Contrary to Hoffman (1972), who believed in a north-south gradient in size increase of the gonofemoral process, there seems to be no coherent pattern in the distribution of U shapes, except that they are relatively constant micro- rather than macrogeographically. This is evident from the Albanian samples alone. Thus, in the north (*e.g.* at Bogë), U resembles that depicted by Verhoeff (1932) for *thessalorum lychnitis* or *comma*, only a little longer and more strongly curved. At neighbouring Theth, U is even longer. On the other hand, at Merkurth (Fig. 3F), Divjaka and some other places, U is more or less simple and triangular, displaying a condition somewhat intermediate between *thessalorum*, which is known also from Valona (Vlorë), Albania, and Macedonia, and *albanicum*, which has also been reported from Albania and Macedonia. At Dhërmi (Figs 3G-J), U is S-shaped, much as in *comma*, which has hitherto been recorded only in Epirus and Corfu, and *macedonicum*, the latter known from Macedonia within both ex-Yugoslavia and Greece. In the south of Albania, at Gjirokaster or Petrani, U is again *thessalorum*-like.

Of course, to distinguish populational/microgeographical variability from the individual one, has more materials to be collected and considered throughout the *Petalysium/carinatum* range. This remains a challenge for future investigations.

Ecologically, this also seems to be a quite homogeneous group, which is not present in caves, except by chance (trogloxenic, see Strasser 1974). As regards the geographical distribution of *carinatum*, it is quite vast and coherent, being confined mainly to the western part of the Balkan region and ranging from the Rijeka Gulf, Slovenia, in the north down to Corfu and Epirus, Greece, in the south (see Strasser 1974), also being recorded in Macedonia as well as in Bulgaria (Ceuca 1973).

Acanthopetalum subpatens n.sp.
(Fig. 4)

MATERIAL EXAMINED. — **Leskoviku District.** Cave on the road Permet-Leskoviku, 5 km before Leskoviku, 900 m,12.V.1995, holotype ♂ (NHMS), leg. P. Stoev & B. Petrov; paratypes together with holotype: 2 ♂♂, 1 ♀ (NHMS); 1 ♂, 1 ♀ (MNHN, Collection Myriapodes F 015), 1 ♂, 1 ♀ (ZMUM). — Same locality, 1.VI.1994, 3 ♂♂, 1 juv. ♂ (NHMS), leg. T. Ivanova.

ETYMOLOGY. — Name emphasizes the especially close relationship with *patens*.

DIAGNOSIS

By its bifid solenomerite and the somewhat serrate outer margin of its tibiotarsus, *subpatens* approaches *furculigerum* Verhoeff, 1901, from Crete, with the very closely related species or even subspecies *patens* Strasser, 1973, described from Epirus, Greece, and *albidicolle* Verhoeff, 1900 (see above). However, it differs from these in the generally smaller body size (less than 45 mm in length, lesser number of body segments (45 *vs* 46), shape of the male coxa 7; as well as in the lack of gonopod process ha (*sensu* Strasser 1973, 1976), present in *furculigerum* s.l. (see review by Strasser 1976), and from *albidicolle* by the dark collum and some minor details of gonopod structure (see Verhoeff 1900).

DESCRIPTION

Length of adults 32-42 mm, width 2.0-3.0 mm, regardless of the sex; length of holotype *c.*42 mm, height of midbody somite 3.0 mm, width 2.8 mm. Most often forty-five body segments, only rarely forty-four (one female).

Coloration in alcohol pale to rather dark grey-brown-reddish, delicately marbled, with a rather indistinct, small, rounded, pale yellowish to reddish spot anteroventrad of ozopores, also with a similar but even smaller, subtriangular, dorsomedian spot at bottom of a shallow suture between pro- and metazona. Axial line poorly visible, sometimes slightly paler than background. Head and antennae darker, brown, vertex and genae especially strongly marbled; eye patches blackish. Both front and caudal ends a little darker than the rest of body. Sometimes caudal margin of metazona narrowly blackish. Legs yellowish to reddish. Juvenile particularly pale.

Ocelli rather poorly convex yet evident, arranged in rows of 7 + 7 + 7 + 6 + 5 + 4 + 3 + 2 + 1 in adults. Frons densely setose, very strongly flattened and even slightly concave (male) or faintly convex (female). Antennae long, slender, *in situ* surpassing somite 5 (male) or 4 (female). Body segments slightly compressed laterally. Collum and somite 2 costulate only laterally, virtually smooth dorsally. Subsequent somites typically densely costulate all over circumference, midbody metazona with forty-eight evident ribs, prozona distinctly striate/ribbed, only suture in between smooth. Surface dull. Tergal setae dorsal and dorsolateral in position, relatively short, *ca.* one third as long as metazonital length only on a few anteriormost and posteriormost terga, inbetween even shorter, often abraded; pattern as 6 + 6 or 5 + 5 on collum and somites 2-4 in a single median row, alternatively 3 + 3 and 3 + 3 on somites 5 and 6 in two rows (one closer to suture, the other near caudal margin), thereafter 6-7 + 6-7 in a single caudal row. Ozopores small but evident, starting from somite 5, each opening behind a small knob.

Legs relatively long, about as long as midbody height, especially densely setose ventrally, with

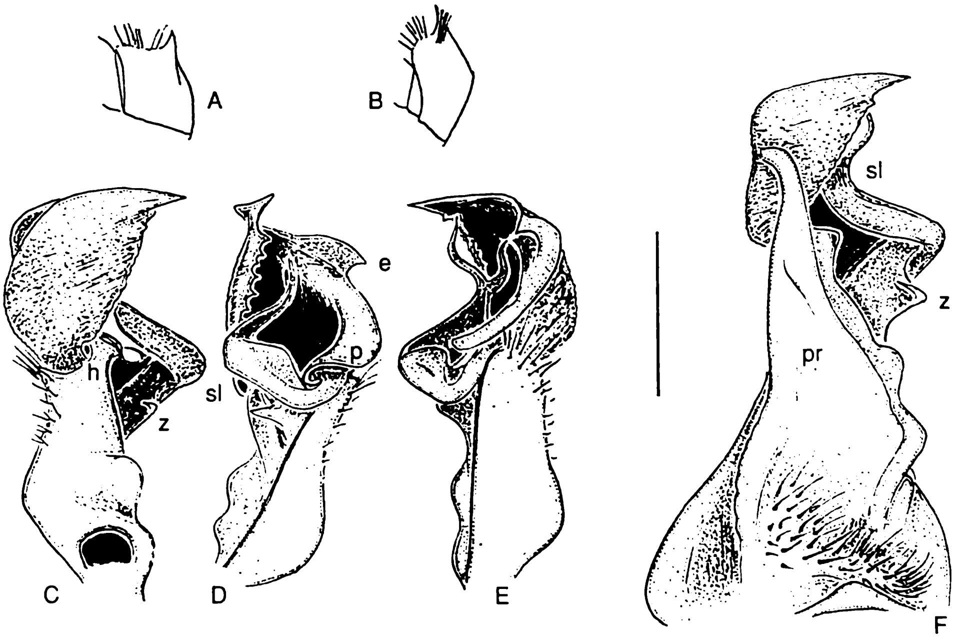


FIG. 4. — *Acanthopetalum subpatens* n.sp., ♂ paratype: **A**, coxa 6, caudal view (drawn not to scale); **B**, coxa 7, caudal view (drawn not to scale); **C-F**, gonopod, various aspects. Scale bar: C-F, 0.5 mm.

ventral brushes on male tibiae and pretarsi until about posterior 1/3 of the body, gradually thinning out thereafter; male coxae 3-6 each with a distinct ventromedian tooth (Fig. 4A), male coxa 7 with a very low, rounded lobe before a similar tooth (Fig. 4B); male postgonopodal prefemora each with a distinct laterobasal swelling.

Gonopods (Fig. 4C-F) typical for the genus, coxal process (pr) not acuminate, solenomerite (sl) bifid, tooth (z) at its base small, tibiotarsus slightly striate mesally and serrate at incurved outer margin, tooth (e) strong but short, process (h) short and blunt, fold (p) gently rounded.

Acanthopetalum sp. indet.

MATERIAL EXAMINED. — **Librazhd District.** Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 5 ♀♀, 1 juv. ♀, of two distinct colour patterns (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♀, 1 juv. ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Shkodër District. Alpet Mt. Rhadohimës, 1900-2200 m, 28.V.1995, 1 ♀ (NHMS), leg. P. Beron.

REMARKS
In the absence of adult male, these samples could not be identified to species.

Order CHORDEUMATIDA C. L. Koch, 1847
Family ANTHROLEUCOSOMATIDAE Verhoeff, 1899

Anamastigona albanensis n.sp.
(Figs 5, 6)

MATERIAL EXAMINED. — **Tirana District.** Petrela, *c.*15 km SE of Tirana, 350 m, scrub, ruins, under stones, 9.V.1995, holotype ♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov; paratypes together with holotype: 2 ♂♂, 1 ♀ (NHMS), 1 ♂ (MNHN, Collection Myriapodes DA 254), 1 ♂ (ZMUM).

ETYMOLOGY. — Name emphasizes the fact that this is the first species of this genus to be reported from Albania.

DIAGNOSIS
Differs from congeners mainly by particularities in the gonopods and paragonopods structure, especially the median piece of the former and the telopodite of the latter.

DESCRIPTION
Body with thirty segments in both sexes. Head, collum, telson and metazona brown, with a pair of somewhat paler small dorsal spots between macrochaetae; prozona grey; genae and distal halves of legs pale brown; basal halves of legs pale.

Measurements (in mm) and number of ocelli:

	Length	Horizontal diameter	Vertical diameter	Length of antenna	Ranks of ocelli
♂ holotype	11	0.95	0.85	1.6	7 (1234321)
♂ paratype	11.5		0.80	1.4	6 (123432)
♂ -	12		0.75	1.3	6 (223432)
♂ -	11		1	1.7	6 (123432)
♂ -	11.5		0.90	1.55	5 (12343)
♀ -	12.5		1.05	1.75	7 (1234321)

Vertex regularly convex in both sexes; antennae rather slender, antennomere 6 *c.*6 times as long as wide; gnathochilarium with a transversely divided mentum; cheeks globular. Eye patches black, triangular, each with a reduced number of ocelli (13-16) arranged in 5-7 rows.
Collum semi-lunar, with a moderately strongly concave posterior margin and 3 + 3 short macrochaetae (half as short as those on midbody segments). Dorsum slightly convex. Metaterga (Fig. 5) from each side with two little dorsolateral swellings neatly separated by a lateral longitudinal sulcus (q). Latter oblique, lying dorsad frontally and more ventrad caudally, separating lateralmost (and most convex) boss which supports on its dorsalmost part (adjacent to sulcus) both external macrochaetae, anterior and posterior, from medianmost boss. Latter poorly convex, subcircular in shape, lentiform, lying rather far from axial suture and supporting a median macrochaeta by its anteromedian part. Macrochaetae long and arched; median one a little longer than others, almost half as long as total width of metazonite. Distance between

median macrochaeta and axial line about twice as great as that between it and anterolateral macrochaeta, and almost 4 times as great as that between both external macrochaetae, angle being 110-120°. Telson without particulars. Walking legs a little longer than vertical diameter of a midbody somite.

Male

Male pregonopodal legs (pairs 3-7) clearly incrassate due to prefemora and femora as compared to others, tarsi particularly long and slender (Fig. 6A, C). Tarsal papillae absent. Coxal glands present on male pairs 10 and 11 (Fig. 6B, C), coxa 11 with a peculiar distoventral process.

Gonopods (Fig. 6D-G) rather strongly differing in structure from those observed in other fifteen congeners known to date: unpaired part (v) very strongly reduced to a small, simple, barbed, trapeziform lobe flanked by two robust, elongated and arched processes. Anterior process (a) a little longer, more external, bearing a basal spur (r), slightly denticulate in its distal one third on caudal side. Posterior process (b) arising laterobasally of (v), subdivided distally into arched spinulations. Both processes (a) and (b) apparently closely attached to each other normally, each with an apical hyaline lobe more or less serrate at margin. More basally, process a supplied with a laterobasal tooth (remnant of telopodite) (t), and process b, flanked by a large, well-visible, caudal lobe (u). All these elements placed on a large sternum, frontally carrying a pair of swellings (s) partly masking spurs r of process a.

Paragonopods (Fig. 6H) quite typical for the genus, having two paramedian, membranous processes and two long, arched, lateral arms, but strongly resembling *Bulgarosoma crucis* Strasser, 1960, in having no traces of a telopodital knob (only pigmented spots in its stead), and in the presence both of a hyaline rectangular lamella at its three quaters extent and denticulations on the internal side of its distal one quater extent.

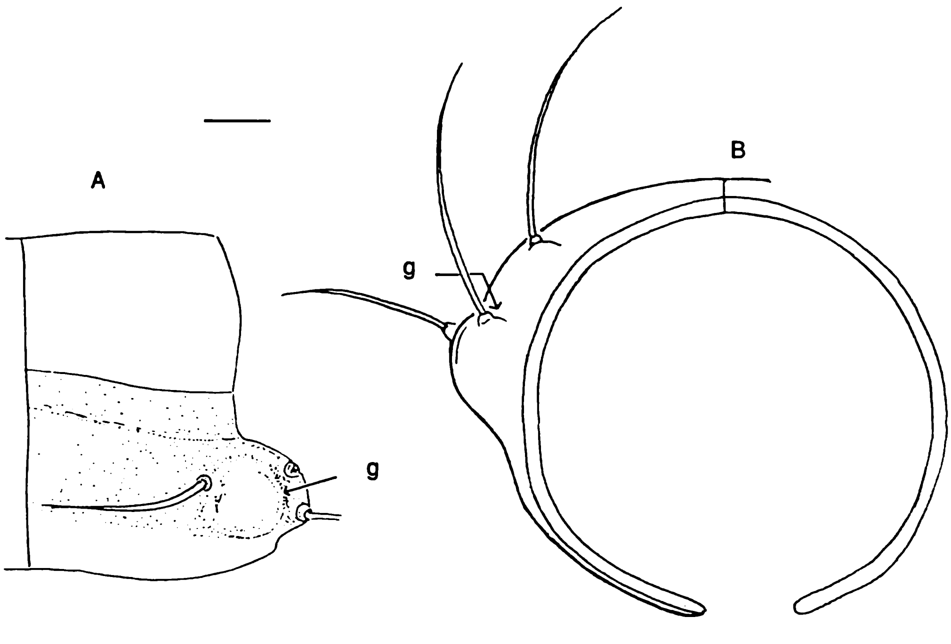
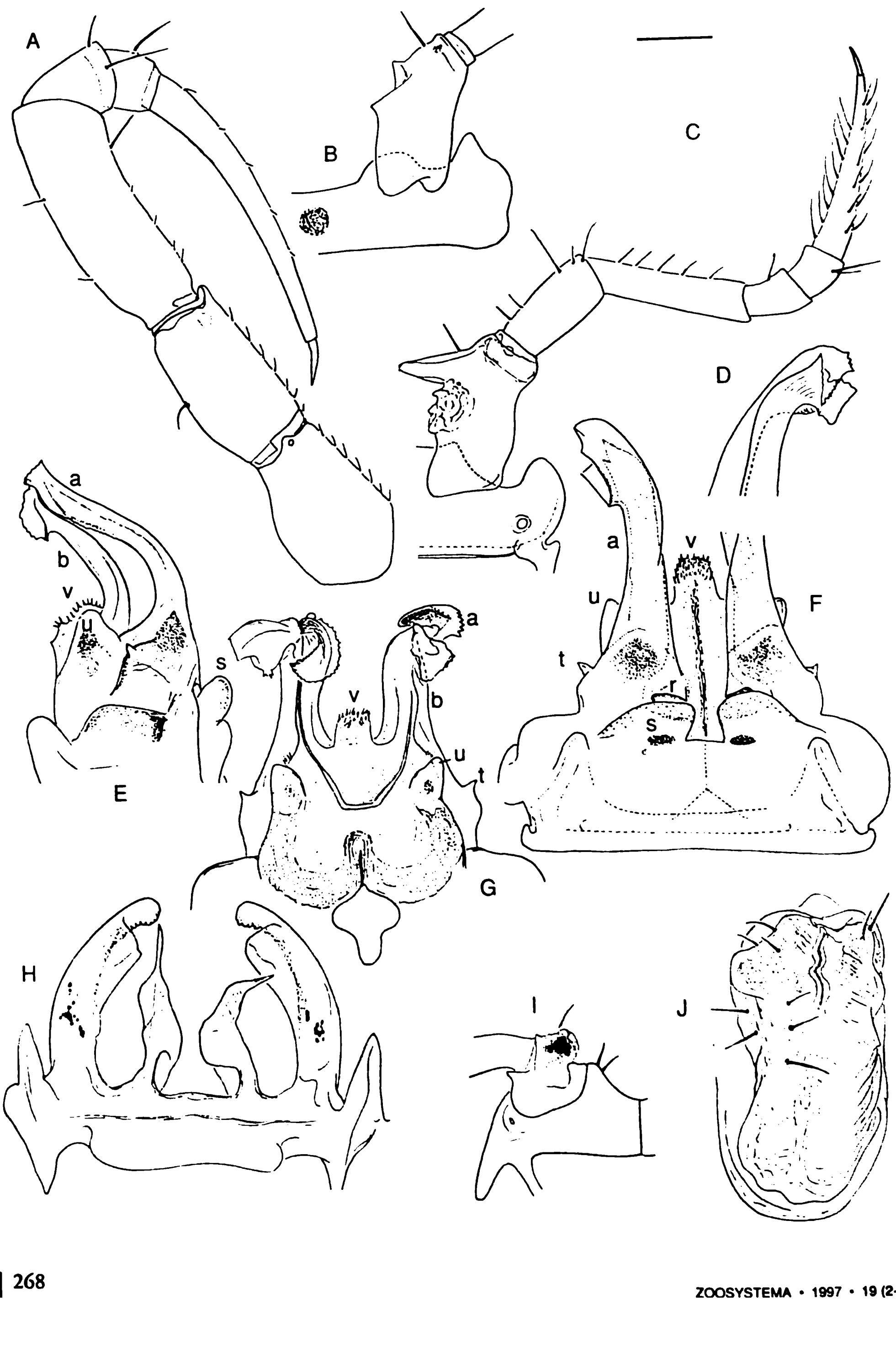


FIG. 5. — *Anamastigona albanensis* n.sp., ♂ holotype, somite 15. A, dorsal view; B, frontal view. Scale bar : 0.1 mm.


A
B
C
D
E
F
G
H
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J
a
b
v
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Female

Coxa 2 (Fig. 6I) with an evident glandular outgrowth distoventrally.

Vulvae of Anthroleucosomatidae *s.l.* have hitherto been illustrated only very seldom (*Persedicus martensi* Mauriès, 1982, from Iran and Talysh Mts, Azerbaijan, and *Haasia largescutatum* (Strasser, 1935), from Slovenia), and never in the genus *Anamastigona*. Figure 6J shows the right vulva of the sole female at hand. Bursa typical for Chordeumatida, *i.e.* strongly elongated, valves symmetrical, pilosity very strongly reduced, with only a few setae sparsely dispersed on external valve and, especially so, only retained anteriorly on internal valve. Ampulla and suture visible mostly anteriorly, outlined by sinuous lips/contours. Operculum poorly emarginate distally.

REMARKS

The Anthroleucosomatidae *s. str.* as we conceive of it, consists of three groups of genera, each group probably warranting the recognition of a separate subfamily. The first is composed of *Alloiopus* Attems, 1951, *Persedicus* Mauriès, 1982, and *Ghilarovia* Gulicka, 1972; the second of *Anthroleucosoma* Verhoeff, 1899, *Heteranthroleucosoma* Ceuca, 1964, and *Dacosoma* Tabacaru, 1968; and the third of *Anamastigona* Silvestri, 1898, *Bulgarosoma* Verhoeff, 1926, *Caucaseuma* Strasser, 1970, *Adshardicus* Golovatch, 1981, and *Ratcheuma* Golovatch, 1985. The latter two Caucasian genera may well prove to be junior synonyms of *Caucaseuma*, but this problem seems better deferred until the extremely rich anthroleucosomatid fauna of the Caucasus is more fully described. On the other hand, the allocation of *Bulgardicus* Strasser, 1960, to this family is doubtful (*cf.* Hoffman 1980).

We here interpret *Anamastigona* in a somewhat broader sense than Hoffman (1980), adding also *Paraprodicus* Verhoeff, 1940, a taxon heretofore considered as a separate genus, to the list of its synonyms or subgenera (together with *Antrodicus* Gulicka, 1967, *Balkandicus* Strasser, 1960, *Hellasdicus* Verhoeff, 1940 and *Osmandicus* Strasser, 1960).

FIG. 6. — *Anamastigona albanensis* n.sp., ♂ holotype (A-H) and ♀ paratype (I-J): **A**, leg 7; **B**, coxa 10, caudal view; **C**, leg 11, caudal view; **D-G**, gonopods (P.8), mesocaudal (of anterior and posterior processes), lateral, oral, caudal views, respectively; **H**, paragonopods (P.9), oral view; **I**, ♀ coxa 2; **J**, vulva, ventral view. Scale bar: 0.1 mm.

Anamastigona (?) sp.

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1000-1100 m, 5-9.VI.1993, 1 juv. ♀ (28 segm.) (NHMS), leg. P. Beron & B. Petrov (No. 581). **Tirana District.** Mt. Dajti, *c.*20 km NE of Tirana, 1000 m, *Fagus*, *Acer*, etc. forest, leaf litter and under bark, 9.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

In the absence of adult male, this material could not be identified to species. Even its generic attribution of the juvenile is doubtful, while the female seems to represent *albanensis*.

Melogona broelemanni Verhoeff, 1897

MATERIAL EXAMINED. — **Tirana District.** Mt. Dajti, *c.*20 km NE of Tirana, 1000 m, *Fagus*, *Acer*, etc. forest, leaf litter and under bark, 9.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

This Balkan-Carpathian species has already been reported from Albania (Attems 1929).

Chordeumatida gen.sp.?

MATERIAL EXAMINED. — **Shkodër District.** Bogë, upper camp, 1900 m, 22.V.1993, 1 juv. ♂ (28 segm.) (NHMS), leg. P. Beron. — Same locality, cave No. 25, 23.V.1993, 8 ♀♀, 3 juv. (NHMS), leg. P. Beron & B. Petrov (No. 577).

REMARKS

In the absence of adult males, this large, depigmented, probably troglobitic species could not even be identified to family. Apparently, it represents a new anthroleucosomatid genus and species still to be described from already available males deriving from the same area (W. A. Shear, pers. comm.).

Order POLYDESMIDA Leach, 1815
Family POLYDESMIDAE Leach, 1815

Brachydesmus herzogowinensis Verhoeff, 1897

MATERIAL EXAMINED. — **Leskoviku District.** Cave on the road Permet-Leskoviku, 5 km before Leskoviku, 900 m, 12.V.1995, 1 ♂, 4 ♀♀, 40 juv. (NHMS), 1 ♂, 1 ♀, 10 juv. (MNHN, Collection Myriapodes JC 296), 1 ♂, 2 ♀♀, 10 juv. (ZMUM), leg. P. Stoev & B. Petrov.

REMARKS
Somewhat misspelt since its original description, either as *hercegovinensis* or as *herzegowinensis*, this species has hitherto been reported from Albania, Montenegro and Cherso (see Attems 1959). However, as the earlier record by Attems (1929) referred to Hercegovina and Montenegro (see also Strasser 1976), the above is the first confirmed discovery of *B. herzogowinensis* in Albania proper. Numerous "subspecies" of *herzogowinensis*, the validity of which is highly doubtful, have since been described, notably from Bulgaria, Serbia, Croatia and Slovenia. Hence the range of this species covers much of the Balkan Peninsula.

Brachydesmus (?) sp.

MATERIAL EXAMINED. — **Sarandë District.** Ionian coast, Borsh, under stones, 5.V.1994, 3 juv. ♂♂ (subadults, 18 segm.) (NHMS), leg. P. Stoev.
Shkodër District. Bogë, 1000-1100 m, 5-9.VI.1993, 1 juv. ♂ (18 segm.) (NHMS), leg. P. Beron & B. Petrov (No. 581). — Alpet Mt. Rhadohimës, 2200-2400 m, 29.V.1993, 2 ♀♀ (19 segm.) (NHMS), leg. P. Beron (No. 599).

REMARKS
In the absence of adult male, no closer identification could be possible.

Polydesmus herzogowinensis Verhoeff, 1897

MATERIAL EXAMINED. — **Shkodër District.** Bogë, Maya Tchardakut, 1200-1400 m, 1.VI.1993, 1 ♀ (NHMS), leg. P. Beron.
Leskoviku District. 5 km from Leskoviku, 1.VI.1994, 1 ♂ (NHMS), leg. P. Tenchev.

REMARKS
This Balkan species has already been recorded in Albania (Attems 1929), yet almost always misspelt since the original description (Verhoeff 1897), mostly either as *hercegovinensis* or *herzegowinensis*. Also, there might be a nomenclatorial problem if *Brachydesmus* is formally treated as a subgenus of *Polydesmus* (*e.g.* Hoffman 1980), because in the same paper, Verhoeff (1897) also described a *Brachydesmus herzogowinensis* (see above). If merged under a single genus, one of these species would have to be renamed to avoid homonymy and conform to the rules of priority. For the time being, however, we prefer to keep both names concerned in separate genera.

Polydesmus mediterraneus oertzeni
Verhoeff, 1901

MATERIAL EXAMINED. — **Tirana District.** Tirana, Botanical Gardens, 8.V.1995, 1 ♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS
This east Mediterranean subspecies ranges from the Balkan Peninsula in the west to the Crimea, W Caucasus and W Anatolia in the east, and seems to have already been recorded in Albania sub *mediterraneus* Daday, 1890 (Manfredi 1945).

Polydesmus (?) sp.

MATERIAL EXAMINED. — **Shkodër District.** Above Bogë, 1500 m, 18.VI.1994, 1 juv. ♀ (NHMS), leg. T. Troanski.
Sarandë District. Ionian coast, Dhërmi, under stones, 2.V.1994, 2 juv. (NHMS), leg. P. Stoev.

REMARKS
In the absence of adults, it has been impossible to determine these samples to species.

POLYDESMIDAE gen. sp.

MATERIAL EXAMINED. — **Sarandë District.** Ionian coast, Dhërmi, 100 m, leaf litter, 11.V.1995, 5 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Librazhd District. Between Hotolisht and Librazdh, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 1 ♀ (20 segm.) (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

Remarks

In the absence of adult males, it has been impossible to identify these samples to species or even genus.

Family Paradoxosomatidae Daday, 1889

Metonomastus petrelensis n.sp.
(Fig. 7)

Material examined. — **Tirana District.** Petrela, *c.*15 km SE of Tirana, 300 m, artificial galleries near road, 9.V.1995, holotype ♂ (NHMS), leg. P. Stoev & B. Petrov; paratypes together with holotype: 6 ♀♀ (NHMS), 1 ♂, 2 ♀♀ (MNHN, Collection Myriapodes JA 123), 1 ♂, 2 ♀♀ (ZMUM).

Etymology. — Name derived from Petrela, the type locality.

Diagnosis

Differs from congeners by the gonopods consisting of two long, slender, subequal branches, of which the solenomerite is unciform apically, and the tibiotarsus is particularly simple (see also key below).

Description

Body with nineteen segments in both sexes. Female considerably larger than male. Length of male 5.65 mm (holotype), of females 6.90-7.85 mm; female dimensions as follows: length 7.80 mm, width of head 0.70 mm, length of antennae 1.25 mm, width of collum 0.52 mm, width of somite 10 0.70 mm on metazonite, 0.65 mm on prozonite.

Habitus usual for the genus, body pallid throughout, slender and moniliform. Pore formula normal (5.7.9.10.12.13-17).

Head globular, a little broader than metaterga (0.60 mm in holotype), covered with sparse, unequal setae. Antennae medium-sized (1.2 mm in holotype), length ratios of antennomeres 3 > 2 = 6 > 5 = 4 < 7 > > 8, the sixth being widest, subcylindrical and 1.5 times as long as

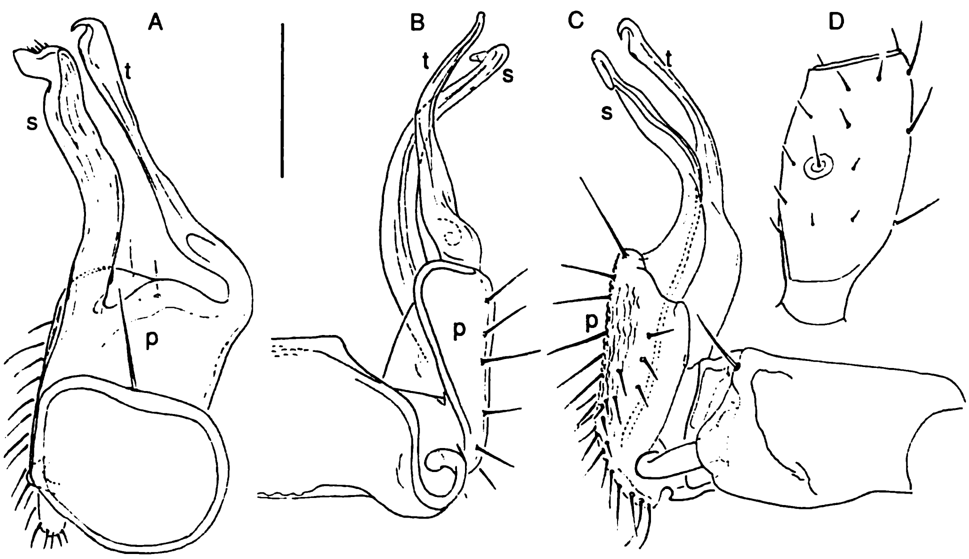

Fig. 7. — *Metonomastus petrelensis* n.sp., ♂ holotype: A-C, right gonopod, oral, lateral, and mesal views, respectively; D, femur 4, ventral view. Scale bar: 0.1 mm.

wide; antennomeres 2, 3 and 4 distinctly claviform. Collum a little narrower, 0.45 mm in width.
Metaterga (width 0.55 mm in holotype) with surface very delicately shagreened. Paraterga poorly developed, lateral margin regularly arched in dorsal view, always with three setae; dorsal surface convex, with moderate pilosity arranged in two rows, both consisting of 4 + 4 thin and short setae (paratergal setae included). An incomplete row, comprising 1 + 1 or 2 + 2 similar setae laterally, also located a little in front of marginal row. Ozopores placed at posterior angle of paraterga. Telson as usual for the genus.

Pregonopodal legs without particulars, except femur 4 with a trichobothrium-like seta on ventral side (Fig. 7D).

Gonopods (Fig. 7A-C) relatively slender, suberect. Prefemur a subquadrate plate (in oral or caudal view), flattened, oral surface setose. Postfemoral region consisting of only two branches, both simple, slender and arched: solenomerite (s), mesal in position, indistinctly sinuous and spinulose distally, a little more robust and shorter than the particularly slender, apically unciform tibiotarsal branch (t) proper.

REMARKS

The genus *Metonomastus* Attems, 1937 (= *Microdesmus* Verhoeff, 1901, *nom. praeoccup.*, see Jeekel 1970), has hitherto been known to comprise nine species or subspecies scattered from (mainly) Italy in the west to Anatolia in the east. Only a few appear to be cavernicolous, *petrelensis* obviously being one of these. Long reported also from Bosnia and Hercegovina, as well as from Greece, this genus is here recorded in Albania for the first time.

GONOPOD-BASED KEY TO DISTINGUISH *petrelensis* FROM ITS RELATIVES

1. Gonopod prefemur suboval and considerably shorter than postfemoral elements .... *M. albus* (Verhoeff, 1901): Bosnia and Hercegovina

— Prefemur subquadrate and about as long as postfemoral elements 2

2. Three postfemoral elements .... *M. strasseri* Hoffman *et* Lohmander, 1968: Turkey
.... *M. strasseri atticus* Strasser, 1974: Greece

— Two postfemoral elements 3

3. Postfemoral elements of two subequal, slender and sinuate branches ....
.... *M. petrelensis*: cave in Albania

— Postfemoral elements stouter, not equal in length/width ....
.... *M. hirtellus* (Silvestri, 1903): Umbria (Italy)
.... *M. capreae* (Verhoeff, 1942): Capri (Italy)
.... *M. patrizii* Manfredi, 1950: cave in Umbria (Italy)
.... *M. romanus* (Verhoeff, 1951): Latium (Italy)
.... *M. mariae* (Strasser, 1965): cave in Abbruzzi Mts (Italy)

The male of *M. bosniensis* (Verhoeff, 1901), is unknown.
Microdesminus saetosus Strasser, 1960, from Italy, differs readily from *Metonomastus* by its abundant tergal pilosity and gonopod structure, the latter, due to two unequal branches of the tibiotarsus, resembling certain *Polydesmus*.

Order JULIDA Leach, 1815
Family BLANIULIDAE C. L. Koch, 1847

Nopoiulus kochii (Gervais, 1847)

MATERIAL EXAMINED. — **Lushnja District.** Divjaka Natural Park, *Pinus halepensis* and *P. pinea* strand forest, litter and under stones, 10.V.1995, 4 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS
This ubiquitous anthropochore has long been reported from Albania (Attems 1959), though without exact provenance.

Family JULIDAE Leach, 1815

Leptoiulus macedonicus (Attems, 1927)

MATERIAL EXAMINED. — **Shkodër District.** Above Bogë, Alpet Mt. Rhadohimës, 2400-2550 m, 29.V.1993, 1 ♂ (NHMS), leg. P. Beron.
Tirana District. Mt. Dajti, *c.*20 km NE of Tirana, 1000 m, *Fagus*, *Acer*, etc. forest, litter and under stones, 9.V.1995, 1 ♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS
This species has hitherto been known only from Macedonia (Attems 1927, 1929), the above being the first definite record of *macedonicus* in Albania. Strasser (1976) also reported it from Albania, yet mentioning no relevant material.

Leptoiulus trilineatus (C. L. Koch, 1847)

MATERIAL EXAMINED. — **Librazhd District.** Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 2 juv. ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Tirana District. Mt. Dajti, *c.*20 km NE of Tirana, 1000 m, *Fagus*, *Acer*, etc. forest, leaf litter and under stones, 8.V.1995, 1 ♂, 2 juv. ♂♂, 1 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Lushnja District. Divjaka Natural Park, *Pinus halepensis* and *P. pinea* strand forest, 10.V.1995, 24 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Vlorë District. Near Dukati, 450 m, leaf litter, 11.V.1995, 2 ♂♂, 14 ♀♀, 34 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Sarandë District. Ionian coast, Dhërmi, under stones, 2.V.1994, 1 ♀ (NHMS), leg. P. Stoev. — Same locality, 100 m, leaf litter, 11.V.1995, 1 ♀, 1 juv. ♂, 21 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Leskovik District. 5 km from Leskovik, 1.VI.1994, 1 ♂ (NHMS), leg. P. Tenchev.

REMARKS
This Alpine-Balkan-Carpathian (*s.l.*) species has long been reported from Albania (Attems 1929), where it appears to be quite common.

Leptoiulus sp.

MATERIAL EXAMINED. — **Shkodër District.** Bogë, Maya Tchardakut, 1200-1600 m, 1.VI.1993, 2 ♀♀, 2 juv. ♂♂, 3 juv. ♀♀ (NHMS), leg. P. Beron. — Above Bogë, Alpet Mt. Rhadohimës, 2400-2550 m, 29.V.1993, 1 ♀ (NHMS), leg. P. Beron (No. 578).

REMARKS
In the absence of adult males, these samples could not be identified to species.

Typhloiulus beroni n.sp.
(Fig. 8)

MATERIAL EXAMINED. — **Korçë District.** Pustec (Liqena), artificial gallery, 5.X.1994, holotype ♂ (NHMS), leg. P. Beron; paratypes together with holotype: 2 ♂♂, 2 ♀♀, 1 juv. ♀, 1 juv. (NHMS), 2 ♂♂ (MNHN, Collection Myriapodes EB 070), 2 ♂♂ (ZMUM).

ETYMOLOGY. — Name honours Dr. Petar Beron, who collected this (and many other) species.

DIAGNOSIS
Differs from congeners by a peculiar combination of non-modified mouthparts, unciform epiproct, and certain details of gonopod structure (see also remarks below).

DESCRIPTION
Body of adults with forty-five (four apodous) to fifty-five (two apodous) segments, excluding telson, in male, and fifty-two (two apodous) and fifty-five (two apodous) segments, excluding telson, in females. The largest juvenile female with forty-six (five apodous) segments, excluding telson. Holotype with fifty-three (three apodous) segments, excluding telson. Length usually 25-26 mm regardless of the sex, rarely from

*c.*20 mm (male with forty-five segments) up to *c.*29 mm (male with fifty-five segments). Midbody width usually 1.0 mm, height 1.5 mm in males (including holotype), 1.3 and 1.7 mm, respectively, in females; body therefore slender and considerably compressed laterally. Coloration in alcohol from pallid grey-yellow-pinkish to dark brownish-bronzed.

Head without particulars except for eye patches pallid and scarcely discernible due to faint rugosity, labrum with usual three large median teeth, vertigial setae 1 + 1, supralabral ones 2 + 2, labral ones 8 + 8. Antennae (Fig. 8A) always pallid, slender, rather long, *in situ* almost reaching the end of somite 4 (male) or 3 (female, juv.), antennomeres 5-6 each with a terminal corolla of more (fifth) or less (sixth) large, bacilliform sensillae. Gnathochilarium (Fig. 8B) without peculiarities, male cheeks not enlarged.

Collum with large, rounded, striated flaps laterally, bare dorsally, with 5 + 5 long setae near caudal margin. Postcollar constriction very poorly developed, subsequent segments with equally long tergal setae tending to increase in length dorsally (*c.*1/8-1/9 as long as midbody height) and in number caudally, first also 5 + 5 and then gradually up to 15-16 + 15-16 on caudalmost somites. Body surface almost dull; prozona very delicately, sparsely and obliquely striate laterally, bare dorsally; metazona strongly, rather regularly and relatively densely striate longitudinally all over their circumference, *ca.* four striae in a conventional square with side equal to metazonital length just below ozopore. Suture between prozona and metazona thin but evident, constriction weak. Ozopores rather distinct, lying behind, quite close to yet not touching the suture. Telson especially densely setose, epiproct characteristically unciform distoventrad (Fig. 8C), anal valves very faintly margined caudally, subanal scale subtriangular.

Male pleurotergum 7 (Fig. 8D) with a distinct, almost pointed, distomarginal tooth directed somewhat obliquely caudally. Legs long, slender, a little over one half as long as midbody height; claws characteristically long, slightly curved, with a minute ventrobasal tooth. Male legpair 1 (Fig. 8E) as usual reduced, unciform, setose; pair 2 (Fig. 8F) with fused coxae and peculiar ventral pads on postfemora and tibiae; pads on subsequent male postfemora tending to rapidly disappear already toward several postgonopodal legpairs; pads on male tibiae gradually disappearing only towards caudal one third of body. Penes behind male legpair 2 without peculiarities, slender, clearly bifid.

Gonopods (Fig. 8G) relatively slender, with both meso- and, especially, promerite only slightly shorter than opisthomerite. Promerite (pr) spatulate, about 4 times as long as broad, slightly concave and tuberculate-rugose in distal two thirds for accomodation of an anterodistally convex and similarly tuberculate-rugose mesomerite (m), with a long, normal flagellum at base; parabasal internal lobe (i) well-expressed, with three strong setae; parabasal external lobe (= remnant of telopodite) (e) subovoid, somewhat smaller in size than i. Opisthomerite (op) with subequal, relatively small, velum (ve) and solenomerite, former supplied with a frontal, subapical, flagellar outgrowth, which is delicately barbed apically and carries an additional, anterodistal, hyaline, median lamella.

REMARKS

The type series contains a peculiar, obviously abnormal male (now in MNHN) which has not one but two pairs of gonopods placed - judged from the typically shaped pleuroterga - inside two, superficially normal, somites 7 and 8. The specimen was left intact, non-dissected, and not examined for further teratological details.

The prolific "tribe" Typhloiulini is currently divided into two main subgroups, one possessing a flagellum on the promerite (male P.8), and the other one lacking it. The former subgroup encompasses *Typhloiulus* Latzel, 1884 (with a good number of subgenera), *Leptotyphloiulus* Verhoeff, 1899, *Alpityphlus* Strasser, 1967, *Buchneria* Verhoeff, 1941, and *Mesoporoiulus* Verhoeff, 1905, while the latter group the genera *Trogloiulus* Manfredi, 1931, and *Serboiulus* Strasser, 1962. Generally, they range from the Maritime Alps, SE France and Italy in the west to the Carpathian Mts in the east, centering in and slightly north of the Balkan Peninsula.

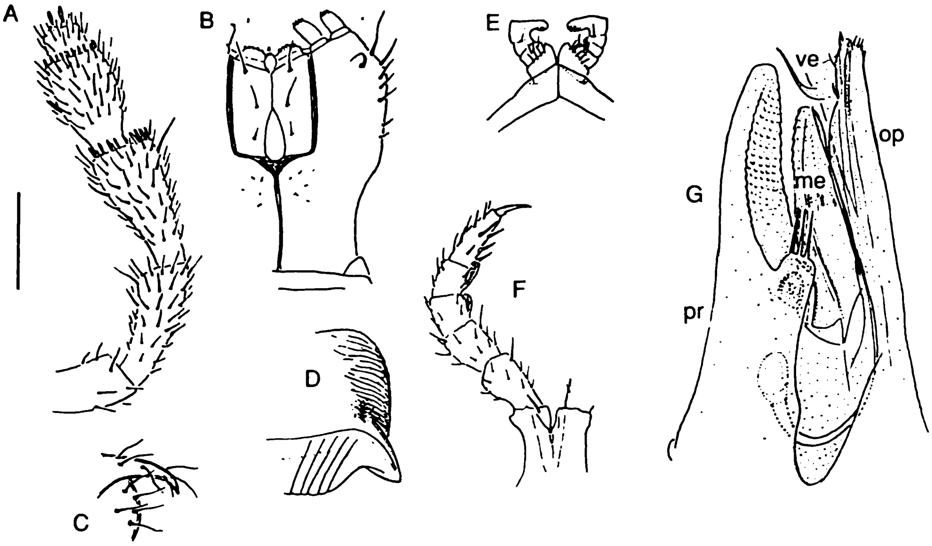

FIG. 8. — *Typhloiulus beroni* n.sp., ♂ paratype: **A**, antenna; **B**, gnathochilarium; **C**, epiproct, lateral view (drawn not to scale); **D**, pleurotergite 7; **E**, legpair 1, oral view; **F**, leg 2, oral view; **G**, gonopod complex, mesal view. Scale bar: 0.2 mm (A-F) and 0.1 mm (G).

Several typhloiuline species are troglobionts, others are largely presumed petro- and/or geophiles, hence virtually all are eyeless, mostly more or less strongly pallid, often long-legged, and sometimes have strongly modified mouthparts. However, all these characters are basically highly adaptive, reflecting the mode of life rather than common ancestry. For this reason alone, the Typhloiulini is highly suspicious as a taxon, this fact having long been acknowledged in the literature (*e.g.* Strasser 1962; Hoffman 1980).

As usual in diplopod systematics, it is gonopod structure that appears most instructive in unravelling the real phylogenetic relations between the consituent typhoiuline species and genera as well as of the Typhloiulini as a whole with other tribes. Basically, there are no apomorphies whatever in typhloiulines which would distinguish them from the sympatric yet somewhat more widely distributed, Euro-Mediterranean tribe Leptoiulini. Indeed, the entire variation range of typhloiuline gonopod structure (presence/absence of a flagellum, promerite shorter/longer vis-à-vis meso- and/or opisthomerite, degree of development of a velum, etc.) definitely lies within that of the leptoiulines. So we must simply admit the existence within the single (very large, but really natural) tribe Leptoiulini of rather numerous, often apparently polyphyletic representatives displaying clear-cut adaptations to troglo-, petro- and/or geophily. In other words, we are inclined to formally abandon the Typhloiulini and to suppress it under the Leptoiulini (*cf.* Strasser 1962; Hoffman 1980).

The genus *Typhloiulus* Latzel, 1884, has hitherto been known to comprise thirty-four described (and a few still undescribed) species or subspecies (several based solely on females) ranging from Italy in the west to Rumania and Bulgaria in the east. Its subgenera *Typhloiulus* s. str. (= *Xestotyphloiulus* Verhoeff, 1899, = *Smeringolophus* Attems, 1959), *Stygiiulus* Verhoeff, 1929, *Attemsotyphlus* Strasser, 1962, *Haploprotopus* Verhoeff, 1899, *Spelaeoblaniulus* Ceuca, 1956 (= *Spelaeoiulus* Strasser, 1962), *Inversotyphlus* Strasser, 1962, as well as the particularly closely

allied *Leptotyphloiulus*, *Alpityphlus*, *Buchneria* and *Mesoporoiulus* are distinguished almost solely by some relatively minor details of gonopod structure: length of pro- or mesomerite in relation to opisthomerite, degree of development of a velum and a few other outgrowths on the opisthomerite, degree of curvature of the opisthomerite, etc. Unique non-gonopodal or gonopod characters are very few (*e.g.*, the leg-like male P.1 in *Haploprotopus*, or the particularly slender meso- and opisthomerite in *Buchneria*), and each such case has resulted in mono- to oligotypy. The borders between all these taxa are almost always far from clear-cut, being likely to disappear with the description of next new typhloiuline species based on males. That many species await discovery/description is beyond doubt.

This statement appears well justified by the above new Albanian *Typhloiulus*. This form comes closest to a whole number of species, many of which have hitherto been allocated in different (sub)genera. Indeed, due to its relatively slender pro- and mesomerite, *T. beroni* approaches certain *Stygiiulus* (e.g. *Typhoiulus ausugi* Manfredi, 1953 and *T. maximus* Verhoeff, 1930), *Attemsotyphlus* (e.g. *T. edentulus* Attems, 1959), *Haploprotopus* (e.g. *T. ganglbaueri* (Verhoeff, 1898)), *Spelaeoblaniulus* (e.g. *T. serbani unilineatus* Ceuca, 1961), *Inversotyphlus* (e.g. *T. longipes* Strasser, 1974), *Alpityphlus* (e.g. *T. seewaldi* Strasser, 1967), as well as *Buchneria cornuta* Verhoeff, 1941, *B. sicula* Strasser, 1959, etc. However, it differs readily by a peculiar combination of the non-modified mouthparts, unciform epiproct, large and setose inner lobe of the straight promerite, small but evident velum supporting a front flagelliform outgrowth, distally barbed, caudally unarmed opisthomerite, etc.

In other words, the entire (sub)generic classification of typhloiuline Leptoiulini seems completely out of date (*cf.* Strasser 1962), requiring a thorough revision. However, such a challenge is best left for the future, when (presumably numerous) new and still poorly known species become adequately documented. Some species assemblages may well prove natural, monophyletic (e.g. *Trogloiulus*, see Enghoff 1985), but most others seem highly heterogeneous at present (*cf.* Hoffman 1980).

Cylindroiulus boleti (C. L. Koch, 1847)

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1000-1100 m, 5-9.VI.1993, 1 ♂ (NHMS), 1 ♂, 1 ♀ (MNHN, Collection Myriapodes EB 036), leg. P. Beron & B. Petrov.
Librazhd District. Between Hotolisht and Librazhd, 100 m, scrub, gravel, under stones and bark, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

This species has hitherto been known mainly from the Alps, Balkans, and Carpathians, with the adjacent foothills and plains of Italy, Austria, Hungary, Rumania, Bulgaria and Moldavia. It has already been recorded in Albania (Attems 1927, 1929), which probably represents the southern range limit.

Brachyiulus apfelbeckii Verhoeff, 1898

MATERIAL EXAMINED. — **Tirana District.** Tirana, Botanical Gardens, under stones, 8.V.1995, 1 ♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Vlorë District. Vlorë, *Olea europaea* forest, under stones, 1.V.1994, 1 ♂ (MNHN, Collection Myriapodes EB 300), leg. P. Stoev & D. Zaprianova.

REMARKS

This Balkan species has hitherto been reported only from Bosnia and Hercegovina, Montenegro, N Greece and Bulgaria, so this new record in Albania is hardly surprising.

Brachyiulus varibolinus Attems, 1904

Brachyiulus beratinus Manfredi, 1945, **syn. n.**

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1008 m, 3-4.VI.1993, 1 ♂, 1 ♀ (NHMS), 1 ♂ (MNHN, Collection Myriapodes EB 326), 1 ♂ (ZMUM), leg. P. Beron & B. Petrov.

REMARKS

With the material at hand, a direct comparison between the very crude drawings of gonopod structure presented by Manfredi (1945) for her *B. beratinus* (described from Berati, S Albania) and the good illustration of a topotype of *B. varibolinus* given by Strasser (1976), leaves no doubt that we face the same creature, hence the

new synonymy. Although *varibolinus* has been reported only from Epirus, N Greece and Albania, the record from Bogë, in the extreme north of Albania, might be evidence of a wider distribution in the Balkan region. It seems opportune to recall that most *Brachyiulus* species are currently quite widespread to ubiquitous, partly through human agency.

Brachyiulus sp. indet.

MATERIAL EXAMINED. — **Librazhd District.** Above Prenjas, 750 m, scrub on slope, under stones and bark, 7.V.1995, 2 ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

Regrettably, in the absence of male, these specimens could not be identified to species, although, judging from their relatively large size, they all probably belong to *apfelbeckii*.

Megaphyllum bosniense (Verhoeff, 1897)

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1000-1100 m, 5-9.VI.1993, 1 ♂, 12 ♀♀, 1 juv. ♂, 2 juv. (NHMS), leg. P. Beron & B. Petrov. — Bogë, Maya Tchardakut, 1200-1400 m, 1.VI.1993, 2 ♂♂, 1 ♀ (NHMS), leg. P. Beron. — Above Bogë, 1800-1900 m, pitfall trapping, 20-23.V.1993, 2 ♂♂ (NHMS), leg. P. Beron & B. Petrov. — Theth, 800-900 m, 28.V.1993, 1 ♀ (NHMS), 1 ♂, 1 ♀ (ZMUM), leg. P. Beron.
Librazhd District. Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones & bark, 7.05.1995, 2 ♀♀, 29 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Cafa-San at border of Macedonia, 1150 m, under stones, 13.V.1993, 1 ♀ (NHMS), leg. P. Stoev.
Tirana District. Mt. Dajti, *c.*20 km NE of Tirana, 1000 m, *Fagus*, *Acer*, etc. forest, leaf litter, under stones and bark, 9.V.1995, 1 ♂, 1 ♀ (MNHN, Collection Myriapodes EB 037), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

This Balkan (*s.l.*) species seems rather common in Albania, whence it has long been recorded (Attems 1927, 1929).

Megaphyllum hercules (Verhoeff, 1901)

MATERIAL EXAMINED. — **Vlorë District.** 4 km S of Vlorë, under stones, 1.V.1994, 1 juv. ♂ (NHMS), leg. P. Stoev. — Pass Llogorasë, 1025 m, badly deteriorated *Pinus* stand, under stones, 12.V.1995, 1 ♂, 1 ♀, 13 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Librazhd District. Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♀ (MNHN, Collection Myriapodes EB 122), 4 juv. ♂♂, 2 juv. ♀♀, 1 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Leskovik District. 1 ♀ (NHMS), 13 km N of Ersekë, near road, leaf litter, 12.V.1995, leg. S. Golovatch, P. Stoev & B. Petrov.
Korçë District. Komnik (= Kamenice), under stones, 7.V.1994, 1 ♀, 1 juv. (NHMS), leg. P. Stoev.

REMARKS

This Balkan (*s.l.*) species also seems to be rather common in Albania, whence it has long been recorded (Attems 1929; Manfredi 1945).

Megaphyllum imbecillum (Latzel, 1884)

MATERIAL EXAMINED. — **Leskovik District.** *c.*13 km N of Ersekë, near road, leaf litter, 12.V.1995, 1 ♂, 1 ♀ (NHMS), 1 ♂ (MNHN, Collection Myriapodes EB 131), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

Several varieties of this species are known (Strasser 1976), all confined to Epirus, N Greece. New to Albania.

Megaphyllum karschi (Verhoeff, 1901)

MATERIAL EXAMINED. — **Vlorë District.** Albania, near Dukati, 450 m, leaf litter, 11.V.1995, 1 ♂ (NHMS), 1 ♂ (MNHN, Collection Myriapodes EB 341), leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS

As far as we are aware, this obviously rare Albanian endemic species has never been recovered since its original description (Verhoeff 1901). The new sample at hand can be regarded as topotypic, as it too originates from the vicinity of Vlorë (= Aulona, = Valona).

Megaphyllum sp.

MATERIAL EXAMINED. — **Shkodër District.** Bogë, Maya Tchardakut, 1600-1800 m, 1.VI.1993, 1 ♀, 1 juv. (NHMS), leg. P. Beron. — Same locality, 1800-1900, pitfall trapping, 20-23.V.1993, 1 ♀, 2 juv. ♀♀ (NHMS), leg. P. Beron & P. Stoev.
Tirana District. Tirana, Botanical Gardens, under stones, 8.V.1995, 2 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Gjirokaster District. Gjirokaster, castle, under stones, 6.V.1994, 2 ♀♀, 2 juv. ♀ (NHMS), leg. P. Stoev.

REMARKS
In the absence of adult male, these samples could not be identified to species.

Acanthoiulus fuscipes (C. L. Koch, 1847) (Fig. 9)

Julus idriensis C. L. Koch, 1847,
Julus dalmaticus C. L. Koch, 1847,
Iulus fuscipes var. *leuconotus* Latzel, 1884,
Iulus fuscipes var. *subcrassus* Latzel, 1884,
Pachyiulus bosniensis Verhoeff, 1895, syn. n.
Pachyiulus fuscipes var. *krohnii* Verhoeff, 1898,
Pachyiulus fuscipes altivagus Verhoeff, 1899, syn. n.
Pachyiulus fuscipes plasensis Verhoeff, 1910, syn. n.
Pachyiulus fuscipes simplex Verhoeff, 1910, syn. n.

MATERIAL EXAMINED. — **Shkodër District.** Theth, 800-900 m, 28.V.1993, 1 ♂ (α), 1 ♀ (NHMS), leg. P. Beron (No. 561). — Above Bogë, Maya Tchardakut, 1600-1800 m, 2.VI.1993, 1 ♂ (β) (NHMS), leg. P. Beron. — Same locality, 1.VI.1993, 2 ♂♂ (β), 1 ♀ (NHMS), leg. P. Beron. — Bogë, 1000-1100 m, 3-9.VI.1993, 1 ♂ (α), 6 ♀♀ (NHMS), 1 ♂ (α) (MNHN, Collection Myriapodes EB 103), 1 ♂ (α) (ZMUM), leg. P. Beron & B. Petrov (No. 569). — Above Bogë, 1800-1900 m, 20-23.V.1993, 1 juv. (NHMS), leg. P. Beron & B. Petrov. — Same locality, 1300 m, Maya Bridashit, 20.V.1993, 1 juv. ♂, 1 ♀ (NHMS), leg. P. Beron & B. Petrov (No. 593). — Same data, 5-9.VI.1993, 1 ♂ (α) (NHMS), leg. P. Beron & B. Petrov (No. 566), 2 ♂♂ (1α, 1β), 3 ♀♀, 1 juv. (NHMS), leg. P. Beron (NB: these males display somewhat different gonopods, and especially striking differences lie in coloration, one with pale legs and somites, the other with bichromous somites - pale dorsally, dark ventrally - and dark legs). — Same locality, upper camp, 1800-1900 m, 20-23.VI.1993, 5 ♂♂ (β), 1 ♀ (NHMS), 1 ♂ (β) (MNHN, Collection Myriapodes EB 103), 1 ♂ (β) (ZMUM), leg. P. Beron & B. Petrov (No. 558). — Same data, pitfall trapping, 20-23.VI.1993, 3 ♂♂ (NHMS), leg. P. Beron & B. Petrov (NB: mesomerite not pointed, promerite with a rounded distal margin carrying a simple tooth). — Alpet Mt. Rhadohimës, 2200-2400 m, 29.V.1993, 2 ♂♂ (2α, 1β), 1 ♀ (NHMS), leg. P. Beron (No. 594) (NB: the male β is paler than others).
Librazhd District. Near Librazhd, 1.X.1994, 1 ♂ (α), 1 ♀, 3 juv. (NHMS), P. Stoev. — Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 1 ♂, 1 ♀, 2 juv. ♂♂, 6 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Tirana District. Petrela, 15 km SE of Tirana, 350 m, under stones, ruins, scrub, 9.V.1995, 5 ♂♂ (γ), 7 ♀♀, 2 juv. ♀, 10 juv. (NHMS), 1 ♂ (γ) (MNHN, Collection Myriapodes EB 103), 1 ♂ (γ) (ZMUM), leg. S. Golovatch, P. Stoev & B. Petrov. — Same locality, 300 m, artificial galleries near road, 9.V.1995, 1 ♀ (NHMS), leg. P. Stoev & B. Petrov.
Lushnja District. Divjaka Natural Park, *Pinus halepensis* and *P. pinea* strand forest, 10.V.1995, 8 ♀♀, 2 juv. ♂♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Rrëshen District. Kurbnesh, cave with ladder, 11.VI.1993, 1 ♀ (NHMS), leg. P. Beron & B. Petrov (No. 570). — Merkurth, under stones, 11.VI.1993, 1 ♀ (NHMS), leg. P. Beron & B. Petrov.

REMARKS
This is obviously the most common and abundant member of the tribe Pachyiulini in the material at hand. Almost all samples are from the north of Albania, and all are more or less grey in colour, sometimes with the middle of the dorsum paler, sometimes with the metazona more strongly brown. In contrast, the legs vary considerably in colour, from pale yellowish to dark brown via red-brown. The epiproct is always present, but its length varies, being mostly a little longer in males than in females.
Two samples from two different, but adjacent, localities deserve special mention. Both contain particularly pale male in which the gonopod structure also appears to be somewhat different from the remaining samples. What seems especially important in this context is that the differences concern the shape of the promerite (P.S), notably of the distomesal outgrowth (Fig. 9C, D, H, I, K-P, d), which has hitherto been considered as one of the basic characters for the discrimination of pachyiuline genera and species. Superficially, using the traditional approaches of

Verhoeff (1901, 1910, 1923), Attems (1902, 1940), Manfredi (1945) or Strasser (1976), such a prominent (d) as in figure 9I or 9P, coupled with certain other distinct features (less strongly rounded lobes on the male cheeks, shorter epiproct, a differently-shaped apex of the meso-

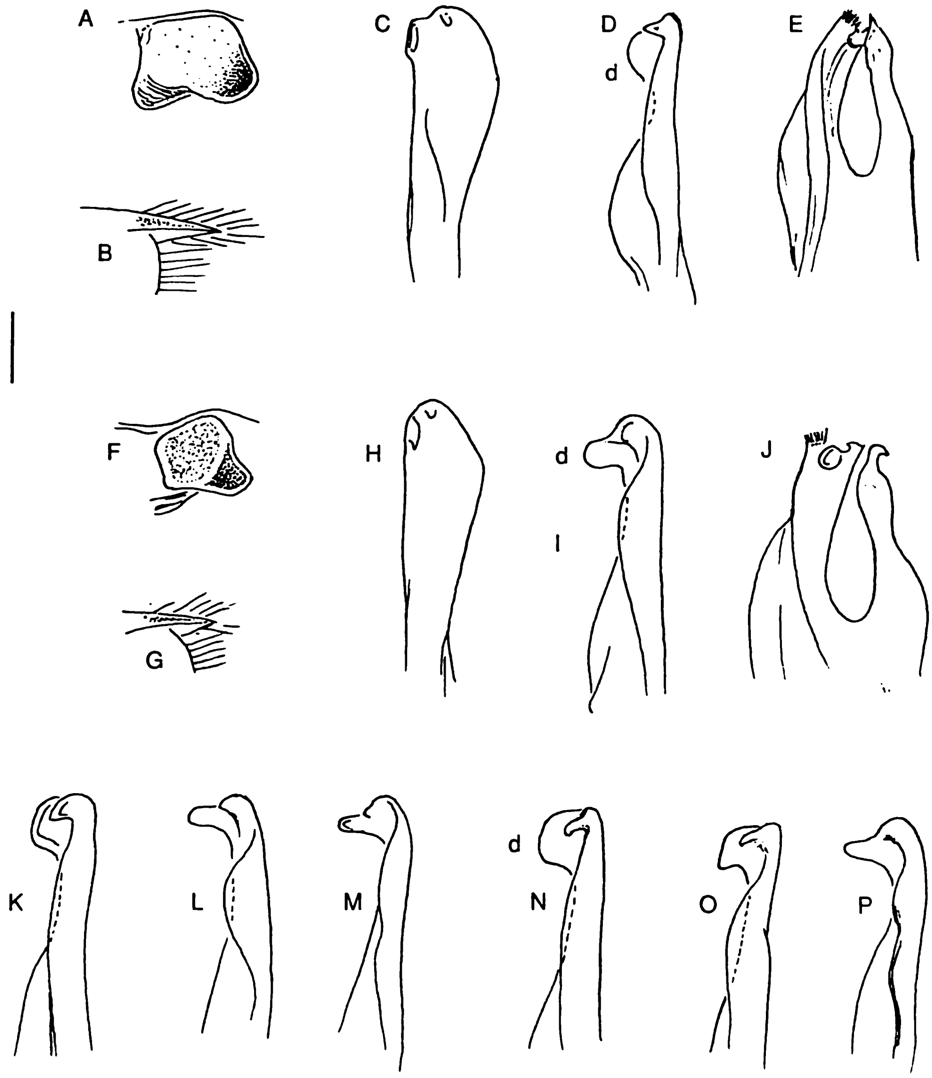

FIG. 9. — *Acanthoiulus fuscipes* (C. L. Koch, 1847), ♂♂ from Rhadohimës (var. α, dark, A-E; var. ß, pale, F-J), Bogë (var. α, K, N; var. ß, L, P), Maya Tchardakut (var. ß, M), and Petrela (var. γ, both body and legs dark, 44 and 49 body segm., O): **A**, **F**, right mandibular stipes, lateral view; **B**, **G**, epiproct, lateral view; **C**, **H**, promerite (= peltogonopod), caudal view; **D**, **I**, **K-P**, promerite, lateral view; **J**, **K**, gonopod (= opisthomerite), lateral view. Scale bar: 0.1 mm.

merite, see figure 9F, G), would immediately warrant a new taxon, at least a new subspecies.

In fact, no less than a dozen subspecies, varieties or synonyms of *fuscipes* are known: (1) *altivagus* (Verhoeff, 1899), first proposed and ever since treated as a subspecies of *fuscipes* (see Verhoeff, 1903, 1910; Attems 1929); (2) *arcadicus* (Verhoeff, 1900), described as a variety of *fuscipes*, but later transferred to *Brachyiulus* (now in *Megaphyllum*) (see Verhoeff, 1903, 1910); (3) *bosniensis* (Verhoeff, 1895), described as an independent species (see also Verhoeff, 1899), but later downgraded to the status of a subspecies of *fuscipes* (see Verhoeff, 1903, 1910; Attems 1929, 1959); (4) *idriensis* (C. L. Koch, 1847), and (5) *dalmaticus* (C. L. Koch, 1847), both originally described as independent species, but later referred to either as a synonym (*cf.* Latzel 1884) or a variety/subspecies, respectively, of *fuscipes* (see Latzel 1884; Verhoeff 1910; Attems 1929, 1959; Manfredi 1932, respectively); (6) *krohnii* (Verhoeff, 1898) and (7) *leuconotus* (Latzel, 1884), both first treated as varieties of *fuscipes* (see Latzel 1884; Verhoeff 1898, 1910; Attems 1929), but later elevated to subspecies (see Attems 1959); (8) *montanus* Verhoeff, *nomen nudum* (?), mentioned as a junior synonym of *idriensis* (see Verhoeff 1910); (9) *plasensis* (Verhoeff, 1910), described and since treated as a subspecies of *fuscipes* (see Verhoeff 1910; Attems 1929, 1959); (10) *simplex* (Verhoeff, 1910), described and since considered as a subspecies of *fuscipes* (see Verhoeff 1910; Attems 1929, 1959); (11) *steinii* (Karsch, 1881), described as an independent species, but later synonymized with *fuscipes* (see Latzel 1884); and (12) *subcrassus* (Latzel, 1884), first established as a variety of *fuscipes* (see Latzel 1884), but later synonymized under *fuscipes fuscipes* (see Verhoeff 1910). Four of those names have been reported from or closely enough to Albania (see Checklist below), while *simplex* has heretofore been recorded solely in N Albania, where our questionable males were found.

The variability in (d) shapes of the N Albanian samples at hand seems to center around two types, α and β, apparently without correlation with any other important character such as coloration, length of the epiproct, shape of the lobe on the male mandibular stipes, etc. (see Fig. 9A-J). We seem to face here a bimodal pattern of infrapopulational variation, which might be evidence of a species in the course of active speciation. Interestingly, whereas both these morphs, α and β, coexist at numerous localities of the Shkodër District, N Albania, further south, at Petrela and Librazhd, a third morph, γ, is observed which is closer to morph α and somewhat bridges the extremes (see Fig. 9O).

Similar observations have been made by Verhoeff (1898, 1899, 1910) in Bosnia, Hercegovina and Dalmatia, where intermediates between *krohnii*, *leuconotus* and *fuscipes fuscipes* (Grundform), but not between *idriensis* and *fuscipes fuscipes*, have been found. Moreover, *plasensis* and *altivagus* appear sympatric (Plasa near Jablanica, Hercegovina, *i.e.* very close to the Albanian border), if not syntopic (Verhoeff 1910). Only with a very modest degree in accuracy, using available descriptions, illustrations and keys (*e.g.* Verhoeff 1910), each of our three *fuscipes* morphs from Albania could be attributed to a definite variety or "subspecies", *e.g.* morph α perhaps to *fuscipes* var. *fuscipes*, morph β probably to *fuscipes* var. *bosniensis*, and morph γ apparently to *fuscipes* var. *idriensis*. However, such determinations hardly make any sense in the light of what is presumably only an infrasubspecific, micropopulational status of these varieties. In addition, the drawings available, if any, in the literature are far too often deficient, further adding to the uncertainty and confusion concerning the present-day level of pachyiuline systematics. To study variation in the shape of the promerite, for instance, not only the conventional caudal, but also a lateral view appears most instructive (see Fig. 9C, D, H, K-P).

Like in *Acanthopetalum carinatum* (see above), the above evidence seems sufficient not only to formally synonymize all currently established subspecies of *Acanthoiulus fuscipes* and downgrade them to the rank of varieties/morphs at best (see Latzel, 1884), but also to question the status of most if not all other pachyiuline "subspecies" as well as of a good number of species, particularly within the prolific, most closely-related, but taxonomically no less badly confused, genus *Pachyiulus* Berlese, 1883 (see also below).

To sum up, *Acanthoiulus fuscipes* can be stated to

represent a highly common and polymorphic Balkan (*s.l.*) species, ranging from NE Italy in the west to Serbia and Macedonia (including the Greek part) in the east and south-east.

The reason we use the name *Acanthoiulus* deserves special attention. Until now (*e.g.* Ceuca 1992), with only a few exceptions (*e.g.* Attems 1959), most authors referred all larger pachyiulines to a single genus, *Pachyiulus* Berlese, 1883, sometimes presenting a subgeneric division. For example, Hoffman (1980) regards no fewer than six names (two invalid) as synonyms or subgenera of *Pachyiulus*, including both *Diploiulus* Berlese, 1883, and *Acanthoiulus* Verhoeff, 1894.

It is important to mention in this connection that Jeekel (1970) considers the name *Diploiulus* by Berlese (1883) as invalidly proposed, without strict typification. The same concerns *Pachyiulus*, which was first erected without strict typification. Only later did Berlese (1886) explicitly designate type species for both genera, namely *Julus rufifrons* C. L. Koch, 1847, for *Diploiulus*, and *Iulus varius* Fabricius, 1781, for *Pachyiulus*. We fully agree with Jeekel (1970) that the later choice of *rufifrons* as the type species of *Diploiulus* was invalid, having been based on a species not mentioned in the original description. Had it been otherwise, the status of the large genus *Cylindroiulus* Verhoeff, 1894, would have again been endangered (see Read 1992). However, we disagree that both generic-level names concerned were proposed invalidly, for reading Berlese (1883) carefully leaves one convinced that the mention of only *Iulus varius* at the end of the original diagnosis of *Pachyiulus*, and of only *Iulus terrestris* Linnaeus, 1758, at the end of the original definition of *Diploiulus*, is sufficient to regard both generic names as typified by monotypy. In other words, both *Pachyiulus* and *Diploiulus* must be considered as properly typified by monotypy, while all subsequent type redesignations and doubts are to be ignored.

Fortunately for *Pachyiulus*, its type species has never been reconsidered since. No less luckily for present-day diplopod taxonomy, the original, valid, designation of *terrestris* for *Diploiulus* automatically makes the latter taxon a junior objective synonym of *Julus* Linnaeus, 1758, a genus based on the same *terrestris*. Hence, *Acanthoiulus* Verhoeff, 1894, becomes the first in the list of subjective synonyms or subgenera of *Pachyiulus*. Applicability of *Acanthoiulus* (= *Oxyiulus* Verhoeff, 1896), as opposed to the remaining *Pachyiulus* s. str., seems to us fully justified for larger pachyiulines displaying a very evident epiproct and (almost) no pseudoflagellum on the solenomerite. There are only two such forms, *fuscipes* and *cassinensis* Verhoeff, 1910, the latter species endemic to S Italy.

Pachyiulus dentiger Verhoeff, 1901
(Fig. 10A, B)

MATERIAL EXAMINED. — **Sarandë District.** Butrinti, 16.IV.1994, 1 ♂ (NHMS), leg. S. Beshkov.

REMARKS

As far as we are aware, this is a second record of *dentiger*, the first since its original description from Vlorë (= Valona), Albania (see Verhoeff 1901). As the opisthomerite has hitherto never been depicted, we present new illustrations of gonopod structure (Fig. 10A, B). The agreement between our sample (length only 25 mm, width 1.8 mm, fifty-two body segments, coloration dark, tarsal soles absent, promerite characteristically shaped and armed, etc.) and the original description seems quite convincing.

P. dentiger appears to be especially closely related to the sympatric *P. valonensis* Verhoeff, 1901, being distinguishable solely by the paler body coloration and larger size of both the distomesal tooth on the promerite and the tooth on the mesomerite.

Pachyiulus cattarensis (Latzel, 1884)

MATERIAL EXAMINED. — **Durrës District.** 4 km N of Durrës, under stones, 25.V.1993, 1 juv. ♂, 1 ♀ (NHMS), leg. P. Stoev & D. Zaprianova. — Same locality, 26.V.1993, 2 ♂♂ (ZMUM), leg. P. Stoev. **Sarandë District.** Himarë, 100 m, under stones, 3-4.V.1994, 1 ♂, 1 ♀ (NHMS), leg. P. Stoev. — Ionian coast, Dhërmi, under stones, 2.V.1994, 1 juv. ♂, 1 ♀, (NHMS), leg. P. Stoev. — Ionian coast, between Dhërmi & Himarë, small niche, 3.V.1994, 1 ♂ (NHMS), leg. P. Stoev. — Between Dhërmi and Himarë, 30.V.1994, 1 ♂, 1 ♀ (NHMS), leg. P. Stoev.

Vlorë District. Vlorë, under stones and soil, 1.V.1994, 1 ♂, 4 ♀♀ (NHMS), leg. P. Stoev & D. Zaprianova. — Vlorë, *Olea europaea* forest, 1.V.1994, 1 ♀, 2 juv. ♂♂, 2 juv. (NHMS), leg. P. Stoev & D. Zaprianova. — Near Dukati, 450 m, 11.V.1995, 2 ♂♂, 2 ♀♀, 1 juv. ♂ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — 10 km N of Fier, under bark, 10.V.1995, 2 ♂♂, 2 ♀♀ (NHMS), leg. S. Golovatch. — Llogorasë Pass, alt. 1025 m, under stones, 11.V.1995, 3 ♀♀, leg. S. Golovatch, P. Stoev & B. Petrov.
Librazhd District. Above Prenjas, 750 m, shrub on slope, 7.V.1995, 13 ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 1 ♂, 4 ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Tirana District. Tirana, Botanical Gardens, under stones, 8.V.1995, 7 ♂♂, 6 ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Petrela, 15 km SE of Tirana, 350 m, ruins, scrubs, under stones, 9.V.1995, 3 ♀♀, leg. S. Golovatch, P. Stoev & B. Petrov.

REMARKS
This common Balkan species has long been known from Albania (Verhoeff 1901; Attems 1929; Manfredi 1932, 1945). Only the males from Fier differ by the slightly more faintly oblique distal margin of the promerite, which is evidence of certain variability of this congener as well.
Due to its unusually slender promerites (= peltogonopods) (P.8) and gonopods (P.9), *cattarensis* is actually perhaps among the most readily recognizable *Pachyiulus* species in the entire Balkan region. Unfortunately, the situation is far less clear as regards the other, very numerous, species, subspecies or varieties encountered in the peri-Adriatic zone (Italy, Greece, Albania, ex-Yugoslavia), e.g. *hungaricus, varius, flavipes, oenologus, apfelbecki*, etc. In some of these and other taxa, all three main distal parts of the gonopod - *i.e.* the pseudoflagellum (Pf) (together with the fovea), the fringed lamella (L), and the seminal branch, or solenomerite (S) - in spite of minor variations, display relatively constant length ratios (*cf.* Attems 1940), allowing for a rather confident species identification. The main combinations are as follows:

Pf = S = L: *P. asiaeminoris* Verhoeff, 1898; *P. lobifer* Attems, 1940 (Pf enlarged);

{Pf = S >> L: *P. oenologus* Berlese, 1885, as depicted by Berlese (1885), which may well be a mistake (see also just below)};

Pf >> S = or a little > L: there are two distinct groups differing in mesomerital structure:

(a) mesomerite enlarged and rounded apically: *P. hungaricus* (Karsch, 1881); *P. hungaricus gracilis* Verhoeff, 1928; *P. asiaeminoris* sensu Attems, 1940;

(b) mesomerite acuminate: *P. oenologus* Berlese (det. A. Berlese, unpublished figures taken from a syntype by H. W. Brolemann, reproduced here in figure 10E, F); *P. flavipes* (C. L. Koch, 1847), *sensu* Attems, 1902; *P. oenologus* sensu Attems, 1902, 1940; *P. oenologus prominens* Attems, 1940; *P. asiaeminoris* sensu Strasser, 1974; *P. cattarensis pluto* Verhoeff, 1910, *sensu* Attems, 1940); *P. krivolutskyi* Golovatch, 1977 (= *Iulus foetidissimus* Muralewicz, 1907, non *Iulus foetidissimus* Savi, 1819, herewith the subjective junior synonym *krivolutskyi* becomes available as a replacement name to avoid homonymy, syn. n.); *P. varius* (Fabricius, 1781), *sensu* Latzel, 1884, and Attems, 1902, 1940; *P. dentiger*.

Numerous taxa, in which gonopods (P.9) have never been figured, seem also to belong to this "*varius/oenologus*" group: *brussensis* Verhoeff, 1941; *brussensis obscurus* Verhoeff, 1941; *cephalonicus* Attems, 1902; *flavipes bosporanum* Verhoeff, 1941; *flavipes insularum* Verhoeff, 1940; *flavipes rufas* Verhoeff, 1900: *humicolus* Verhoeff, 1910; *silvestrii* Verhoeff, 1923; *unicolor aprutianus* Verhoeff, 1930; *unicolor ciminensis* Verhoeff, 1930; *unicolor olivarum* Verhoeff, 1951; *varius pallipes* Manfredi, 1945 (see also below).

Pf >> S >> L: *P. cattarensis*; may be also *P. longelobulatus* Attems, 1902, and *P. cattarensis pseudounicolor* Verhoeff, 1902;

Pf > S > L: *Pachyiulus varius* sensu Berlese, 1885; *P. apfelbecki* Verhoeff, 1901, *sensu* Attems, 1940;

Pf = L > S: *P. speciosus* Verhoeff, 1901 (Pf acuminate);
Pf > S >> L: *P. unicolor milesius* Verhoeff, 1923; *P. flavipes* sensu Lignau, 1903.

Pf > L > S: *P. marmoratus* Verhoeff, 1901.

Some of these taxa differ from each other only in external characters, mainly size and, especially, coloration. Of course their gonopod structure does display minor variations too, but it seems highly homogeneous. Only (Pf) surpasses both distal branches and the mesomerite of P.9, while

in P.8 there is a distomesal tooth of slightly varying shapes. So we consider some further names as actually based on a single, evidently variable species, hence the new synonymy just below.

Pachyiulus varius (Fabricius, 1781)
(Fig. 10C-K)

Julus flavipes C. L. Koch, 1847, syn. n.
Julus nigripes C. L. Koch, 1847
Julus unicolor C. L. Koch, 1847
Iulus oenologus Berlese, 1885, syn. n.
Pachyiulus apfelbecki Verhoeff, 1901, syn. n.
Pachyiulus varius var. *pallipes* Manfredi, 1945, syn. n.

MATERIAL EXAMINED. — **Shkodër District.** Bogë, , Maya Bridashit, 1300 m, 20.V.1993, 1 ♀, 1 juv. ♂ (NHMS), leg. P. Beron.
Tirana District. Mt. Dajti, *c.*20 km NE of Tirana, 1000 m, *Fagus*, *Acer*, etc. forest, leaf litter and under bark, 9.V.1995, 1 ♂, 2 ♀♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Sarandë District. Dhërmi, 16.IV.1994, 1 ♀, 4 juv. ♂♂, 5 juv. ♀♀ (NHMS), leg. S. Beshkov.
Vlorë District. Vlorë, *Olea europaea* forest, under stones, 1.V.1994, 1 ♂ (NHMS), leg. P. Stoev & D. Zaprianova.

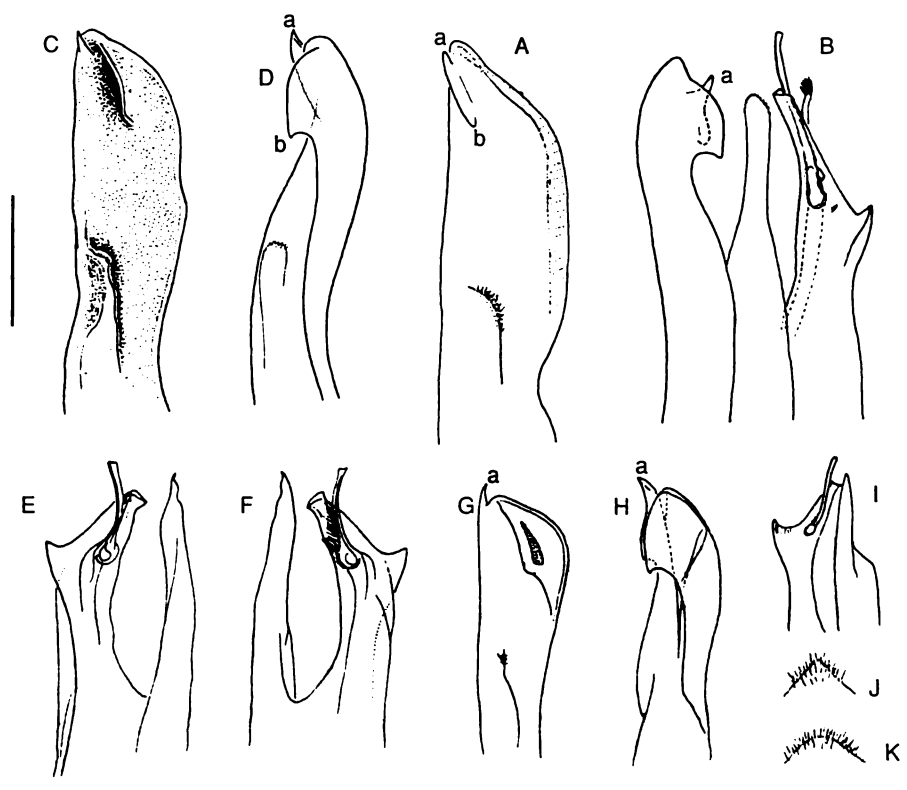

FIG. 10. — *Pachyiulus dentiger* Verhoeff, 1901, ♂♂ from Butrinti (A, B), and *Pachyiulus varius* (Fabricius, 1781), ♂ syntype of *Iulus oenologus* Berlese, 1885, from Firenze (Etruria) (C-F), and ♂♂ from Vlorë (G-J) and Dhërmi (K) : A, C, G, promerite, caudal view; B, entire gonopod complex, lateral view; D, H, promerite, lateral view; E, F, I, opisthomerite, lateral, mesal and lateral views, respectively (E and F, de I. H. W. Brolemann); J, K, epiproct, dorsal view. Scale bar: 0.5 mm.

REMARKS

Although this species is represented in our Albanian samples by only a few adult males, they allow additional light to be shed on its highly confused taxonomy. Already Latzel (1884) recognized the first two junior synonyms of *varius* (*terra typica*: Italy), namely *nigripes* and *unicolor*. However, since then, no serious attempt has been performed to reassess the indeed highly variable *varius*. Instead, numerous new *Pachyiulus* species, subspecies and varieties have been established throughout the Mediterranean, many of them displaying no significant differences, whether it would be between each other or from *varius*, or both. Moreover, one such species, *flavipes* (*locus typicus*: Pola, N Croatia), has been left untouched since Latzel (1884), although he in fact noted its great overall similarity to *varius*, with the differences lying solely in coloration (paler yellowish-brown *vs* brownish-black, respectively). *P. oenologus* was originally described by Berlese (1885) from Etruria, and only a year later did he (1886) report it, as a "new" species, from most of Italy. Hence the first introduction of the name *oenologus* dates fom 1885, not 1886, as currently accepted by mistake. *P. varius, flavipes, oenologus* and some of their "subspecies" or varieties (some even under *unicolor*) have since been reported from south of France in the west to the Crimea and W Anatolia in the east, but in the Balkan region (*s.l.*) none shows a coherent pattern, being dispersed in a random, mosaic-like way.

P. apfelbecki was described from N Greece (Verhoeff 1901), and *varius* var. *pallipes* from Albania (Manfredi 1945); neither seems to have been recorded since.

Fortunately, the MNHN collections contain published and unpublished material of *varius, flavipes* and *oenologus*, allowing direct comparisons to be made. Moreover, one of the *oenologus* samples appears to contain several syntypes (three males and one female), of which one male had previously been revised and even drawn by H. W. Brolemann. We take this opportunity to publish these illustrations for the first time and complement them with our own figures of promerital structure (Fig. 10C-F). These syntypes are in good condition, though perhaps a little faded due to long preservation in alcohol, being gray with brown annulations (metazona); legs pale brownish, collum and telson brown; latter without real epiproct, terminally slightly obtuse, angle *c.*120°; body length *c.*45 (male) to 50 mm (female), diameter 3 (male) to 3.5 mm (female); males with 59(-3), 61(-3) and 63(-3), female with 63(-3) body segments.

As a result, despite pronounced variation in habitus and gonopod structure, a direct comparison of the new Albanian samples (Fig. 10G-K), older material of *flavipes* (from Sicily), *varius* (from Bergamo and Romagna-Meldola, Italy, as well as from Zara, Dalmatia) and *oenologus*, with descriptions and drawings [including several unpublished sketches of *varius* and *flavipes* gonopods, all executed by H. W. Brolemann (iconographic file, MNHN)], along with the available descriptions of *apfelbecki* and *varius* var. *pallipes*, reveals that they all belong to a single, highly variable and widespread (trans-Mediterranean) species, *varius* by priority. There could hardly have been a better name chosen for such a species!

Variation mostly concerns size (our Albanian adults are a little smaller than the above *oenologus* syntypes), coloration (the Albanian samples are blackish throughout), shape of the epiproct (slightly different even within the Albanian samples, *cf.* Fig. 10J, K), outlines of the promerite (the Albanian material is similar to *flavipes bosporanus* Verhoeff, 1941, except that the distal margin is as sinuose as that of *cattarensis*), shape of the distal teeth and lobes on the promerite (the Albanian samples display a large distomedial lobe, rather than a tooth) as well as the form of the caudal tooth on the opisthomerite (from pronounced to almost missing, as noted even for *apfelbecki* by Verhoeff (1901)), etc. What remains quite stable, is the opisthomerite possessing subequally long and very slender (Pf) and (S), both as long as the mesomerite and clearly surpassing (L), *i.e.* as depicted by Berlese (1885).

Pachyiulus hungaricus (Karsch, 1881)

MATERIAL EXAMINED. — **Librazhd District.** Above Prenjas, 750 m, scrub on slope, 7.V.1995, 1 ♂, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. **Vlorë District.** 4 km S of Vlorë, under stones, 2.V.1994, 1 ♀, 1 juv. ♂ (NHMS), leg. P. Stoev. **Sarandë District.** Ionian coast, Dhërmi, under

stones, 2.V.1994, 3 ♀♀ (NHMS), leg. P. Stoev. — Ionian coast, Himarë, under stones, 3.IV.1994, 3 ♀♀ (NHMS), leg. P. Stoev.

REMARK

This very large and easily recognizable Balkan-Carpathian species has long been known from Albania (Attems 1929).

Pachyiulus sp.

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1000-1100 m, 5-9.VI.1993, 3 ♀♀ (NHMS), leg. P. Beron & B. Petrov. — Above Bogë, Alpet Mt. Rhadohimës, 2200-2400 m, 29.V.1993, 3 ♀♀ (NHMS), leg. P. Beron.
Rrëshen District. Kurbnesh, cave with ladder, 11.VI.1993, 1 ♀ (NHMS), leg. P. Beron & B. Petrov (No. 570).
Durrës District. 2 km N of Durrës, under stones, 24.V.1993, 1 juv. (NHMS), leg. P. Stoev & D. Zaprianova. — 4 km N of Durrës, under stones, 16.V.1993, 1 juv. ♂ (NHMS), leg. P. Stoev.
Librazhd District. Between Hotolisht and Librazhd, 300 m, scrub, gravel, under stones and bark, 7.V.1995, 1 juv. ♂, 3 juv. ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov. — Above Prenjas, 750 m, scrub on slope, 7.V.1995, 2 juv. ♂, 1 juv. (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Vlorë District. Levan, 14.IV.1994; 1 ♀ (NHMS), leg. S. Beshkov.

REMARKS

In the absence of adult male, it has been impossible to identify these samples to species, although most adult female seem to belong to *varius*.

Chromatoiulus podabrus bosniensis (Latzel, 1888)

MATERIAL EXAMINED. — **Shkodër District.** Bogë, 1000-1100 m, 3-9.VI.1993, 1 ♂, 2 juv. (NHMS), 1 ♂, 1 ♀ (MNHN, Collection Myriapodes EB 038); leg. P. Beron & B. Petrov. — Same locality, 1800-1900 m, pitfall trapping, 20-23.V.1993, 1 juv. ♂, 1 juv. (NHMS), leg. P. Beron & B. Petrov.

REMARKS

This W Balkan species or subspecies ranges from N Italy in the north(west) down to N Greece in the south. It has already been recorded from Albania (Attems 1929).

Chromatoiulus sp.

MATERIAL EXAMINED. — **Lushnja District.** Divjaka Natural Park, *Pinus halepensis* and *P. pinea* strand forest, litter and under stones, 10.V.1995, 1 ♀ (NHMS), leg. S. Golovatch, P. Stoev & B. Petrov.
Rrëshen District. Kurbnesh, cave with ladder, 11.VI.1993, 1 ♀ (NHMS), leg. P. Beron & B. Petrov.

REMARKS

In the absence of adult male, this material could not be identified closer to (sub)species, although they seem to belong to *bosniensis*.

Order POLYZONIDA Gervais, 1844
Family POLYZONIDAE Gervais, 1844

Polyzonium germanicum Brandt, 1831

MATERIAL EXAMINED. — **Shkodër District.** Bogë, pitfall trapping, IV.1993, 2 ♂♂ (NHMS), leg. B. Petrov & P. Beron. — Same locality, Maya Tchardakut, 1400-1600 m, 2.VI.1993, 1 ♀ (NHMS), leg. P. Beron (No. 595).

REMARKS

This pan-European species has already been reported from Albania (Attems 1929).

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CHECKLIST OF DIPLOPODA OF ALBANIA AND ADJACENT LANDS

A Taxa cited from Albania by Ceuca (1992) and our new species/records;
Mo from Montenegro (Cerna Gora) by Attems (1959) and/or Strasser (1971);
Ma from Macedonia (ex-yugoslav) by Strasser (1971);
nG from Epirus (including Corfu) and/or Greek Macedonia (also unpublished data);
(*) junior synonyms; (?) doubtful taxa.

Taxa	Cited by
POLYXENIDA	
POLYXENIDAE	
Polyxenus lagurus Linnaeus, 1758	Attems 1929, 1959 (Ma)
Polyxenus macedonicus Verhoeff, 1952	(Ma)
GLOMERIDA	
GLOMERIDELLIDAE	
Albanoglomus ljubetensis Attems, 1929	auct., Attems 1959 (Ma)
Typhloglomeris coeca Verhoeff, 1898	Mo)
GLOMERIDAE	
Glomerini	
Glomeris balcanica Verhoeff, 1906	(nG)
Glomeris conspersa porphyrea C. L. Koch, 1847	(Mo)
Glomeris hexasticha Brandt, 1833	Verhoeff 1932; Attems 1929, 1949; (A, Ma, Mo)
var. *ambigua* (Haase, 1886)	Attems 1929
var. *vallicola* Verhoeff, 1906	Attems 1929
Glomeris pulchra pulchra C. L. Koch, 1847	Attems 1929, 1959 (Mo)
var. *conjuncta* Attems, 1927	Attems 1929
var. *wohlberedti* Verhoeff, 1909	auct.
var. *verhoeffi* Attems, 1927	auct.
var. *discreta* Attems, 1927	Manfredi 1945
Glomeris pustulata Latreille, 1804	(A)
Haploglomerini	
Haploglomeris multistriata (C. L. Koch, 1844)	(Mo)
Onychoglomerini	
Onychoglomeris herzogowinensis (Verhoeff, 1898)	auct., Attems 1929, 1959 (A) (Mo) (nG)
? = *Onychoglomeris herzogowinensis media* Attems, 1935	auct., Attems 1959 (A)

Taxa	Cited by
Trachysphaerini	
Hyleoglomeris epirotica (Mauriès, 1966)	(nG)
Trachysphaera acutula (Latzel, 1884)	(nG)
Trachysphaera corcyrea Verhoeff, 1900)	(nG)
Trachysphaera costata (Waga, 1858)	Attems 1929, 1959 (Ma) (nG)
? = *Trachysphaera rotundata* (Lignau, 1911)	(nG)
Trachysphaera schmidtii (Heller, 1858)	
= *nodulifera* (*) (Verhoeff, 1906)	auct., Attems 1929, 1949, 1959 (A)
Tribus incertae sedis	
Epiromeris aelleni Strasser, 1976	(nG)
POLYDESMIDA	
PARADOXOSOMATIDAE	
Metonomastus petrelensis n.sp.	(A)
Stosatea simoni (Daday, 1889)	(A) (Mo) (nG)
(?) *Stosatea cretica* (Verhoeff, 1901)	? (A)
Stosatea granulata Daday, 1889	(nG)
Stosatea minima Strasser, 1976	(nG)
Stosatea sp., aff. *iadrense* (Pregl, 1883)	Strasser 1974 (nG)
Strongylosoma stigmatosum (Eichwald, 1830), non *pallipes* (Olivier, 1792)	auct., Attems 1929, 1949, 1959; Verhoeff 1932 (A, Ma)
XYSTODESMIDAE	
Melaphe vestita (C. L. Koch, 1847)	Attems 1929, 1959
Ochridaphe albanica Verhoeff, 1932	auct. (A) (Ma)
POLYDESMIDAE	
Brachydesmus cernagoranus Attems, 1912	(Mo)
Brachydesmus cornutus Attems, 1903	(Mo)
Brachydesmus dalmaticus Latzel, 1884	(Mo)
Brachydesmus herzogowinensis Verhoeff, 1897	(Ma) (A)
Brachydesmus lapidivagus Verhoeff, 1897	(Mo)
Brachydesmus ljubetensis Attems, 1912	auct., Attems 1929 (Ma)
Brachydesmus lobifer Verhoeff, 1897	(Mo)
Brachydesmus peristerensis Verhoeff, 1932	(Ma)
Brachydesmus stygivagus Verhoeff, 1899	(Mo)
Brachydesmus subterraneus Heller, 1858	Attems 1929, 1949 (A) (Mo)
Brachydesmus vermosanus Attems, 1929	auct., Attems 1959 (Mo)
Brachydesmus zawalanus Attems, 1912	(Mo)
Polydesmus collaris C.L. Koch, 1847	Attems, 1929, 1949 (A) (Ma, Mo)
Polydesmus collaris tussilaginis Verhoeff, 1897	Attems 1959
Polydesmus complanatus (Linnaeus, 1758) = *Polydesmus complanatus illyricus* (*) Verhoeff, 1895	Attems 1929, 1949, 1959 (A) (Mo, Ma) (nG)
Polydesmus herzogowinensis Verhoeff, 1897	Attems 1929, 59; Manfredi 1945 (A) (Ma, Mo) (nG)
Polydesmus mediterraneus Daday, 1889	Verhoeff 1901; Attems 1929, 1959; Manfredi 1945 (A) (Mo)
Polydesmus mediterraneus oertzeni Verhoeff, 1901	auct. (nG)
Polydesmus mediterraneus martensi Strasser, 1967	(nG)
Polydesmus varians Strasser, 1976	(nG)
Polydesmus wardaranus Verhoeff, 1937	Attems 1959 (Ma)
CHORDEUMATIDA	
ANTHROLEUCOSOMATIDAE *s.l.*	
Anamastigona albanensis n.sp.	(A)
Paeonisoma faucium Verhoeff, 1932	auct. (A) (Ma)
CHORDEUMATIDAE	
Melogona broelemanni (Verhoeff, 1897)	Attems 1929, 1949, 1959 (A) (Ma) (nG)

Taxa	Cited by
Melogona broelemanni albanica (Verhoeff, 1901)	auct., Attems 1929, 1959 (A)
Melogona broelemanni banatica (Verhoeff, 1899)	Attems 1959
HAASEIDAE	
Haasea lacusnigri Gulicka, 1968	(Mo)
HETEROLATZELIIDAE	
Heterolatzelia cornuta Gulicka, 1968	(Mo)
Heterolatzelia durmitorensis Gulicka, 1968	(Mo)
Heterolatzelia nivalis absoloni Attems, 1951	(Mo)
NEOATRACTOSOMATIDAE	
Neoatractosoma herzegowinense Verhoeff, 1901	(Mo)
FAMILIA INCERTAE SEDIS	
Epirosomella loebli Strasser, 1976	(nG)
CALLIPODIDA	
DORYPETALIDAE	
Dorypetalum degenerans (Latzel, 1884)	Attems 1929, 1959 (Ma)
Dorypetalum degenerans bosniense (Verhoeff, 1897)	Attems 1959
? = *Dorypetalum trispiculigerum* Verhoeff, 1900	(nG)
SCHIZOPETALIDAE	
Schizopetalini	
Callipodella fasciata (Latzel, 1882)	Attems 1929, 1959
? = *C. trifasciata* (Daday, 1899), ? = *C. dorsovittata* (Verhoeff, 1900)	(A, Ma, Mo, nG)
Callipodella mostarensis (Verhoeff, 1901)	Attems 1929, 1959 (A, Mo)
Callipodella mostarensis kerkana Verhoeff, 1929	Attems 1959 (Mo)
Dischizopetalum illyricum (Latzel, 1884)	Attems 1959
Apfelbeckiini	
Apfelbeckia albanica Verhoeff, 1941	auct., Attems 1959 (A, Mo)
Apfelbeckia albosignata Verhoeff, 1901	Attems 1929, 1959 (Mo)
Apfelbeckia lendenfeldi Verhoeff, 1901	auct. (Mo)
Apfelbeckia lendenfeldi miraculosa Attems, 1951	(Mo)
Apfelbeckia lendenfeldi flavipes Attems, 1929	auct. (A)
Apfelbeckia hessei Verhoeff, 1929, var. *boldorii*	Manfredi 1945, auct. (A)
Apfelbeckia wohlberedti Verhoeff, 1909	auct., Attems 1959 (A) (Mo)
Himatiopetalum ictericum (C. L. Koch, 1867)	(nG)
Prolysiopetalini	
Prolysiopetalum scabratum (C. L. Koch, 1867)	(nG)
Acanthopetalini	
Acanthopetalum (*A.*) *albidicolle* Verhoeff, 1900	(A) (nG)
Acanthopetalum (*A.*) *sicanum* (Berlese, 1883)	(nG)
Acanthopetalum (*A.*) *sicanum epiroticum* Attems, 1935	(nG)
Acanthopetalum (*A.*) *furculigerum patens* Strasser, 1973	(nG)
Acanthopetalum (*A.*) *furculigerum transitionis* Strasser, 1976	(nG)
Acanthopetalum (*A.*) *subpatens* n.sp.	(A)
Acanthopetalum (*Petalysium*) *carinatum* (Brandt, 1840)	Attems 1929, 1959; Manfredi 1945 (A, Mo, Ma)
= *Acanthopetalum* (*P.*) *albanicum* (*) (Verhoeff, 1932)	auct., Attems 1959 (A) (Ma)
= *Acanthopetalum* (*P.*) *comma* (*)(Verhoeff, 1900)	(nG)
= *Acanthopetalum* (*P.*) *macedonicum* (*)Verhoeff, 1923	Attems 1929, 1959 (Ma)
= *Acanthopetalum* (*P.*) *thessalorum* (*)(Verhoeff, 1901)	Attems 1929, 1959 (A)
= *Acanthopetalum* (*P.*) *thessalorum lychnitis* (*) (Verhoeff, 1932)	(A) (Ma)
JULIDA	
NEMASOMATIDAE	
Nemasoma varicorne C. L. Koch, 1847	Attems 1929, 1949 (Ma)
BLANIULIDAE	
Nopoiulus kochii (Gervais, 1847) = *pulchellus* (*) (C. L. Koch, 1838) = *venustus* (*)(Meinert, 1868)	(Ma, nG)

Taxa	Cited by
= *armatus* (*) (Nemec, 1895) = *atticus* (*)Verhoeff, 1925	Attems 1959
JULIDAE	
Brachyiulini	
Brachyiulus apfelbeckii Verhoeff, 1898	Attems 1929, 1959 (A, Mo, nG)
= *Brachyiulus apfelbeckii uncilobus* (*) Attems, *nom. nud.*	Attems 1959 (Mo)
Brachyiulus lusitanus Verhoeff, 1898	(nG) (Ma)
Brachyiulus pusillus (Leach, 1814)	Verhoeff 1901; Attems 1929, 1949, 1959 (A, Mo)
= *Brachyiulus littoralis* (*) Verhoeff, 1898	
Brachyiulus stuxbergi (Fanzago, 1875)	(nG)
Brachyiulus varibolinus Attems, 1904	(A, nG)
= *Brachyiulus beratinus* (*) Manfredi, 1945	auct.
Megaphyllum austriacum (Latzel, 1884)	(Mo)
Megaphyllum bosniense (Verhoeff, 1897)	Attems 1927, 1929, 1959 (A, Mo, Ma)
Megaphyllum bosniense flavopictum (Attems, 1929)	auct.
Megaphyllum carniolense (Verhoeff, 1896)	Attems 1949 (Mo)
Megaphyllum crassum (Attems, 1929)	auct., Attems 1959 (Ma)
Megaphyllum dentatum (Verhoeff, 1898)	Attems 1927, 1929, 1959 (A, Ma)
Megaphyllum hercules (Verhoeff, 1901)	auct., Attems 1929, 1959; Manfredi 1945; (A, Ma, nG)
Megaphyllum imbecillum (Latzel, 1884)	Attems 1949 (nG) (A)
Megaphyllum karschi (Verhoeff, 1901)	auct., Attems 1929, 1959 (nG)
Megaphyllum macedonicum (Strasser, 1976)	(nG)
Megaphyllum margaritatum epiroticum (Strasser, 1976)	(nG)
Megaphyllum metsovoni (Strasser, 1976)	(nG)
Megaphyllum monticola (Verhoeff, 1898)	Attems 1929, 1959 (A, Mo)
Megaphyllum recticauda (Attems, 1903)	(nG)
Megaphyllum recticauda discrepans (Strasser, 1976)	(nG)
Megaphyllum rubidicolle (Verhoeff, 1901)	(nG)
Megaphyllum unilineatum (C. L. Koch, 1838)	Attems 1929, 1949, 1959
Pachyiulini	
Acanthoiulus fuscipes (C. L. Koch, 1847)	Attems 1929, 1959 (A, Mo, Ma, nG)
= *Acanthoiulus fuscipes bosniensis* (*) (Verhoeff, 1895)	Attems 1929, 1959; Manfredi 1945
= *Acanthoiulus fuscipes idriensis* (*) (C. L. Koch, 1847)	Manfredi 1932
= *Acanthoiulus fuscipes simplex* (*) (Verhoeff, 1910)	auct., Attems 1929, 1959
var. *krohnii* (Verhoeff, 1898)	Attems 1929, 1959 (Mo)
var. *leuconotus* (Latzel, 1884)	Attems 1929, 1959 (Mo)
Pachyiulus apfelbecki Verhoeff, 1901	(nG)
Pachyiulus cattarensis (Latzel, 1884)	Verhoeff 1901; Attems 1929, 1959; Manfredi 1932, 1945 (A, Mo, Ma, nG)
var. *pseudounicolor* Verhoeff, 1923	Attems 1959 (Ma)
? = *Pachyiulus longelobulatus* (*) Attems, 1904	(A) (nG)
Pachyiulus dentiger Verhoeff, 1901	auct., Attems 1929, 1959
Pachyiulus marmoratus Verhoeff, 1901	(nG)
Pachyiulus varius (Fabricius, 1781)	Attems 1929, 1949, 1959; Manfredi 1945 (A, Mo, nG)
= var. *pallipes* (*)Manfredi, 1945	auct.
= *Pachyiulus apfelbecki* (*) Verhoeff, 1901	(nG)
= *Pachyiulus flavipes* (*)(C. L. Koch, 1847)	Attems 1929, 1959 (A) (nG)
= *Pachyiulus oenologus* (*) Berlese, 1885	
Pachyiulus hungaricus (Karsch, 1881)	Attems 1929, 1959 (A, Mo, Ma, nG)
Pachyiulus venetus Verhoeff, 1926	Manfredi 1945; Attems 1949
Pachyiulus valonensis Verhoeff, 1901	Attems 1929, 1959 (nG)
Ommatoiulini	
Ommatoiulus sabulosus (Linnaeus, 1758)	Attems 1929, 1949, 1959 (A, M)

Taxa	Cited by
Leptoiulini + Typhloiulini	
Leptoiulus (*Proleptoiulus*) *trilineatus* (C. L. Koch, **1847**)	Attems 1929, 1949, 1959 (A, Ma, Mo)
Leptoiulus (*P.*) *trilineatus plasensis* Verhoeff, 1908	Attems 1959 (Mo)
Leptoiulus (*Oroiulus*) *cernagoranus* (Attems, 1927)	(Mo)
Leptoiulus (*Oroiulus*?) *discophorus* (Attems, 1927)	auct., Attems 1929, 1959 (A, Mo)
Leptoiulus (*O.*) *durmitorius* (Attems, 1927)	(Mo)
Leptoiulus (*O.*) *hauseri* Strasser, 1976	(nG)
Leptoiulus (*O.*) *jaroslavi* **nom. nov.**[1]	auct., Attems 1959 (A, nG)
Leptoiulus (*O.*) *laetedorsalis* (Verhoeff, 1898)	(Mo)
Leptoiulus (*O.*) *macedonicus* (Attems, 1927)	Attems 1929, 1959 (Ma, A)
Leptoiulus (*O.*) *matulicii* (Verhoeff, 1901)	(Mo)
Leptoiulus (*O.*) *pentheri* (Attems, 1927)	auct., Attems 1929, 1959
Leptoiulus (*O.*) *sarajevensis* Verhoeff, 1898	Attems 1927, 1929, 1959 (Ma, Mo)
= *Macedoiulus storkani* (*) Verhoeff, 1932, **syn. n.**[1]	Attems 1959 (Ma)
Leptotyphloiulus coeruleoalbus Verhoeff, 1899	auct. (A)
Typhloiulus albanicus Attems, 1929	auct., Attems 1959 (Ma)
Typhloiulus beroni n.sp.	(A)
Typhloiulus ganglbaueri Verhoeff, 1899	(Mo)
Typhloiulus psilonotus Latzel, 1884	(Mo)
Cylindroiulini	
Cylindroiulus boleti (C. L. Koch, 1847)	Attems 1927, 1929, 1949, 1959 (Ma, Mo)
Cylindroiulus (?) *luridus* (C. L. Koch, 1847)	Attems 1949
Enantiulus nanus acutus (Attems, 1929)	auct., Attems 1959
Oncoiulini	
Chromatoiulus podabrus podabrus (Latzel, 1884)	Attems 1929, 1959 (A, Mo, Ma, nG)
Chromatoiulus podabrus bosniensis (Latzel, 1888)	Attems 1929, 1959 (A, Mo, Ma)
Chromatoiulus (?) *hamuligerus* (Verhoeff, 1932) ♀	Attems 1959 (A, Ma)
Telsonius nycteridonis Strasser, 1976	(nG)
Unciger foetidus (C. L. Koch, 1838)	Attems 1949, 1959
Unciger transsilvanicus (Verhoeff, 1899)	Attems 1949, 1959
Paectophyllini	
Macheirioiulus compressicauda Verhoeff, 1901	Attems 1959 (nG)
POLYZONIDA	
POLYZONIIDAE	
Polyzonium germanicum Brandt, 1831	Attems 1929, 1949, 1959 (A, Ma)
= *Polyzonium germanicum albanicum* (*) Verhoeff, 1932	auct., Attems 1959
HIRUDISOMATIDAE	
Hirudisoma hirsutum Verhoeff, 1901	(nG)
PLATYDESMIDA	
ANDROGNATHIDAE	
Dolistenus savii Fanzago, 1874	(nG)
Fioria mediterranea (Daday, 1889)	(nG)
Plutodesmus typhlus (Daday, 1889)	(nG)

1. Even a superficial comparison of the available descriptions and illustrations of *Leptoiulus sarajevensis* (see Verhoeff 1898; Attems 1927) and *Macedoiulus storkani* (see Verhoeff 1932) leaves no doubt whatever that we face the same creature. Hence the above new synonymy, analogous to that of *Macedoiulus* Verhoeff, 1932, under *Leptoiulus* Verhoeff, 1894, syn. n. Indeed, the only real autapomorphy of *Macedoiulus* vis-à-vis *Leptoiulus* appears the somewhat reduced flagellum of the peltogonopods (male P.8), a highly unstable character which often tends to be lost independently in various julid (and not other) lineages, being at most species-specific. The missing velum on the gonopods proper (male P.9) as well as some other features claimed by Verhoeff (1932) to distinguish his *Macedoiulus* from *Leptoiulus* do not really hold, being shared with some other assumed congeners (see also dicussion above). Unfortunately, the above synonymy requires a new

name to be chosen for *Leptoiulus storkani*, a species proposed by Verhoeff (1932) just two pages following the description of *Macedoiulus storkani*. To avoid homonymy, and still honour Dr. Jaroslav Storkan, the replacement name *Leptoiulus jaroslavi*, nom. nov., is herewith proposed. Interestingly, Strasser (1976) has reported both *sarajevensis* (sub *Macedoiulus storkani*) and *jaroslavi* (sub *Leptoiulus storkani*) from Albania, without mentioning any pertinent material. Hence he seems to have corrected Attems (1929, 1959), who had erroneously placed some neighbouring ex-yugoslav localities in Albania, and introduced some more of his own errors...

Addendum

Only a short time after the redaction of our text, we realize that some recent and interessant works of Mrsic 1987, 1988 and 1993, concerning Macedonia, was remained unknown of us. The last gives the list and chorology of Millipedes of Macedonia, sixty species, of which seventeen are new for Science and Macedonia: *Glomeris pulchra* C. L. Koch, 1847; *Glomeris balcanica* Verhoeff, 1906; *Oxidus gracilis* C. L. Koch, 1847; *Brachydesmus henrikenghoffi* Mrsic, 1993; *Brachydesmus macedonicus* Mrsic, 1988; *Polydesmus collaris tussilaginis* Verhoeff, 1929; *Polydesmus jawlowskii* Strasser, 1966; *Polydesmus juergengruberi* Mrsic, 1993; *Polydesmus mediterraneus oertzeni* Verhoeff, 1901; *Polydesmus renschi* Schubart, 1934; *Schizmohetera sketi* Mrsic, 1987; *Megaphyllum transsilvanicum* (Verhoeff, 1897); *Megaphyllum unilineatum* (C. L. Koch, 1847); *Rhodopiella beroni* Strasser, 1966; *Cylindroiulus arborum* (Verhoeff, 1928); *Cylindroiulus luridus* (C. L. Koch, 1847); *Unciger foetidus* (C. L. Koch, 1838).

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Scorpions (Arachnida, Scorpiones) from the Balkan Peninsula in the collection of the National Museum of Natural History, Sofia

Victor FET

Introduction

Scorpiofauna of the Balkan countries is not well studied. Although numerous papers have been published over more than 150 years describing scorpion taxa from this region, the modern-level synthesis has never been achieved, and even species composition is not clear, especially in the extremely polymorphic genus *Euscorpius* Thorell, 1876 (Euscorpiidae). The most important work up to date is that of KINZELBACH (1975) who compiled all known data on the circum-Aegean region, including all of mainland and island Greece, and also Turkey; some new data on this area were added by FET (1986) and KRITSCHER (1993). Fauna of scorpions of the former Yugoslavia was discussed in some detail by HADZI (1929, 1930), CAPORIACCO (1950), and ĆURČIĆ (1972) but the taxonomic criteria in these works are now outdated. The recent workers on Greece (MICHALIS, DOLKERAS, 1989) also applied outdated taxonomic criteria. Virtually no data, except some old or brief records (YURINICH, 1904; GILTAY, 1932; DANIEL, 1959), exist for Bulgaria and Albania. Recent work on scorpions of the adjacent regions, especially on Italy (BONACINA, 1980), Austria (SCHERABON, 1987), Caucasus (FET, 1993) and the Crimea (FET, 1997a), demonstrated difficulties and gaps in our taxonomic and biogeographic knowledge. This is why the scorpiofauna of the Balkan region requires a close attention: new molecular (mitochondrial DNA) data (GANTENBEIN et al., 1999) indicate that it can serve as a good model system for studying both ancient and recent speciation.

Material and methods

I analysed 173 scorpion specimens deposited in the collection of the National Museum of Natural History, Sofia, Bulgaria (NMNHS), preserved in 75 % ethanol.

Scorpions were identified and studied according to the diagnostic external morphological features, first of all carination of metasoma and variation in trichobothriotaxy (number and position of trichobothria on the pedipalp). Trichobothrial formulae were scored according to the standard techniques (VACHON, 1975; FET, 1993, 1997a). Abbreviations used below are: P.B. - P. Beron leg., Tv - number of trichobothria on the ventral aspect of pedipalp patella (= "tibia"), scored from base to apex; Te - same, on the external aspect, including the following "series" (clusters of 2 to 9) of trichobothria: *et* - terminal; *est* - subterminal; *em* - median; *esb* - suprabasal; eb_a - basal "a"; and *eb* - basal; also *et, est* and *dsb* - external terminal, external subterminal, and dorsal suprabasal individual trichobothria on the fixed finger of the pedipalp chela. In scoring the bilateral meristic characters (pectinal plates, trichobothrial series) the left side is scored first. All linear measurements are given in mm. Selected duplicate specimens from NMNHS are deposited in the collection of the United States National Museum (USNM, Smithsonian Institution, Washington, D.C., USA), with the kind permission of Dr. P. Beron.

Results and discussion

The NMNHS collection contains four species of scorpions belonging to three families and originating from the Balkan countries (Albania, Bulgaria, and Greece), collected mainly by Dr. Petar Beron in 1960-1993. Although the species number in this region is not high, the taxonomy of the most typical regional element found here, the Southern European-Mediterranean genus *Euscorpius* (Euscorpiidae) is so complicated (FET, 1997a, b) that it requires a special treatment and analysis. Below, I give a list of species and localities which is accompanied by the detailed discussion of the genus *Euscorpius*.

Buthidae

***Mesobuthus gibbosus* (Brullé, 1832)**

A very common Eastern Mediterranean species (found from Albania to Lebanon), and the only representative of Buthidae (and of mainly Asian genus *Mesobuthus*) in the Balkans. NMNHS collection has 16 specimens from Albania and Greece (including the Aegean islands of Kythira, Kithnos, Serifos, Tinos, Chios, Karpathos, Rhodes, and Crete).

Albania

2 ♀♀, 1 juv. (No. 132), Ionian Sea, Dhermi, 24.01.1993 (P.B.).

Greece

1 ♀ (No. 48), Peloponnesos, 09. 1981 (P.B.).

1 ♀, 1 ♂ (No. 166), Kythira, near airfield, 30.04.1987 (P.B.).
1 ♀, 1 juv. (No. 159), Kithnos, Dryopis, 9.05.1987 (P.B.).
1 ♀, 1 ♂ (No. 99), same locality, 15.05.1984 (P.B.).
1 ♀ (No. 92), same locality, 16.05.1987 (P.B.).
1 ♂ (No. 91), 1 ♀ (No. 93), Serifos, Coutalas, 0-300 m, 22.04.1984 (P.B.).
1 ♀, 2 subad. ♂♂ (No.35), 1 ♀ (No. 54), Tinos, 1.10.1974 (P.B. and V. Beshkov).
2 ♀♀ (No.160, No. 165), Chios, Passa Limani, 14.05. 1987 (P.B.).
1 juv. (No. 154), Chios, Nea Moni, 13.05.1987 (P.B.).
1 ♀ (No. 89), Karpathos, Archangel Michail, 800-1000 m, 4.05.1984 (P.B.).
1 ♀ (No. 94), Rhodes, Lindos, 30.04.1984 (P.B.).
1 ♀ (No. 97), Rhodes, Lardos, 1.05.1984 (P.B.).
1 juv. ♀ (No.167), Rhodes, Archangelos, 1.05.1987 (P.B.).
1 ♂ (No. 116), Crete, Psiloritis, 1600-2000 m, 11.05.1984 (P.B.).

Iuridae

***Iurus dufoureius* (Brullé, 1832)**

The only species of a monotypic genus, and an interesting relict, endemic to the southern Aegean area (from Peloponnesus to southern Anatolia, including the islands of the southern Aegean arch). NMNHS collection has four specimens from Greece.

Greece

1 ♀, 1 ♂ (No. 68), Peloponnesos, Laconia, Mystras, 18.09.1983 (P.B. & V. Beshkov).
1 ♂ (No. 96), Kasos, Stylokamara Cave, 6.05.1984 (P.B.).
1 ♀ (No. 158), Rhodes, Archangelos, 2.05.1987 (P.B.).

Euscorpiidae

***Euscorpius beroni* n. sp.**

Material. Holotype: ♀ (NMNHS No. 137), Albania, Shkoder District, Boga, Maya Tchardakut, 1400-1800 m, 1.06.1993 (P.B.). Paratypes: 1 ♀ (USNM), same label as holotype; 1 ♂ (USNM), 1 ♀, 3 juv. (NMNHS No. 142), Albania, Shkoder District, Boga, upper camp, 1800-1900 m, 20-25.06.1993 (P.B. and B. Petrov); 3 ♀♀ (NMNHS No. 134), Albania, Shkoder District, Mt. Radohimës, 2200-2400 m, 29.05.1993 (P.B.).

Diagnosis. This species belongs to the complex "*Euscorpius mingrelicus*" which is indicated by an almost obsolete metasomal carination and a high (in the

new species, average 2,10) ratio of distance between trichobothria *et* and *est* to the distance between *est* and *dsb* on the fixed finger of the pedipalp chela.

Etymology. The species is named after its collector, Dr. Petar Beron (Sofia, Bulgaria).

Description. Holotype ♀. A small scorpion, with background coloration medium brown; abdominal part of the mesosoma light brown; legs, pedipalps, and telson brownish, legs, pedipalps and chelicerae with fuscous dark pattern. Surface of tergites, pedipalps femur and patella, and carapace finely granular. Metasomal carinae almost obsolete; ventromedian and ventrolateral carinae absent; traces of dorsolateral carinae with sparse granules (not denticles) on metasomal segments I to IV. Dorsal furrow is present on metasomal segments I to IV, obsolete in the most of metasomal segment V. Telson with darker ventral longitudinal stripe. Number of pectinal plates 7-8. Trichobothrial formula on the pedipalp patella: Tv = 5-5; Te = 21; *et* = 4; *est* = 4; *em* = 3; *esb* = 2; eb_a = 4; *eb* = 4. Measurements: carapace length 3,85; chela manus length 3,95; chela fixed finger length 2,80; metasomal segment V length 3,48; telson length 3,72; telson height 1,12; ratio telson length/telson height 3,32; ratio *et - est / est - dsb* 2,14.

Paratype ♂. Diagnostic characters as in ♀; telson only slightly inflated; number of pectinal plates 9-10. Trichobothrial formula as in the holotype. Measurements: carapace length 2,80; chela manus length 2,46; chela fixed finger length 1,95; metasomal segment V length 2,46; telson length 2,88; telson height 1,2; ratio telson length/telson height 2,40; ratio *et - est / est - dsb* 2,00.

Variation. Among seven ♀♀ paratypes, number of pectinal plates was 8-8 (3 cases), 8-7 (2), 7-8 (1) and 7-7 (1). Trichobothrial formulae were as in the holotype, with the following exceptions: Tv = 5-6 (1 case), *em* = 2-3 (1) and 2-2 (1). Morphometric values (measured for all six adult ♀♀, including holotype) varied as follows: carapace length, average 3,49, SD 0,26; chela manus length, average 3,37, SD 0,43; chela fixed finger length, average 2,64, SD 0,23; metasomal segment V length, average 3,06, SD 0,30; telson length, average 3,35, SD 0,36; telson height, average 1,10, SD 0,09; ratio telson length/telson height, average 3,06, SD 0,45; ratio *et - est / est - dsb*, average 2,21, SD 0,15.

Geographic and altitudinal ranges. Known only from the high mountains (1400 to 2400 m) of the Prokletija massif in the northwestern Albania (Shkoder District). Scorpions have been found on the Mt. Radohimës up to the summit at 2569 m (P. Beron, pers. comm.).

Comments. Recently, FET (1993) reviewed all known distribution and taxonomic composition of the species (*sensu lato*) *Euscorpius mingrelicus* (Kessler, 1874) which was described from Georgia (Caucasus) but later also identified (BONACINA, 1980) as a part of the former species *Euscorpius germanus* (C. L. Koch, 1837). While the latter species is in fact limited to the Alpine zone of Europe, the much more widespread *Euscorpius mingrelicus* is found from the Isonzo (Soca) River valley in Italy and Slovenia to the Georgian and Russian

coasts of the Black Sea. Within this range, the species exhibits high morphological variation with several subspecies described from Slovenia, Croatia, Bosnia and Turkey (BONACINA, 1980; FET, 1993; LACROIX, 1995). It is highly likely that it represents in fact a species complex, as do numerous other terrestrial invertebrates with a Balkan-Caucasian range. A new species from Albania, *E. beroni* n. sp., is a part of this complex but its characters (especially the trichobothrial number on the external aspect of the pedipalp patella and ratio *et - est / est - dsb* on the fixed finger of the pedipalp chela) clearly indicate its difference from, and separate standing among, several other Balkan forms (BONACINA, 1980) as well as from the Anatolian-Caucasian group of "subspecies" clustering around the nominotypical form (FET, 1993; LACROIX, 1995). No species of the "*mingrelicus*" complex was yet recorded for Albania. Ongoing molecular studies (GANTENBEIN et al., 1999; GANTENBEIN, FET et al., in progress) indicate that the separate "*germanus*" and "*mingrelicus*" complexes might belong to an ancient, montane Alpine-Balkan-Caucasian lineage within the genus *Euscorpius*, and most likely include a number of isolated species (which may or may not have well-defined morphological features).

Euscorpius carpathicus* (Linnaeus, 1767), *sensu lato
(="*Euscorpius carpathicus*" complex)

The NMNHS collection has 143 specimens belonging to this complex (species *sensu lato*) from Albania, Bulgaria and Greece. According to the observed morphological features, I separated all studied specimens into several phenotypic groups and subgroups (introduced here with their diagnostic features) to which at this moment I choose not to ascribe any of the numerous known Latin names as subspecies or species. Below, I listed records for each "group" (and a "subgroup" within), with the original, detailed trichobothrial scores for each entry, followed by the discussion.

"Group A". A light-colored form, with moderately reduced metasomal carination and granulation of the carinae; with low to medium trichobothrial numbers on the pedipalp patella ("oligotrichous"). Tv varies from 7 to 10. External series usually with Te from 23 to 25 due to the variation of *et* from 5 to 7; always *est* = 4; practically always (with extremely rare exceptions) *em* = 4, *esb* = 2, eb_a = 4, *eb* = 4.

"Subgroup A1" (47 specimens): Tv from 7 to 8 (average 7,45) with a bimodal distribution (45 % of the scored pedipalps have 7, and 52 % have 8). Te from 23 to 24; *et* from 5 to 6 (average 5,58) with a bimodal distribution (38 % have 5, and 52 % have 6).

Bulgaria

2 ♀♀, 3 ♂♂, 1 ♂ juv. (NMNHS No. 4), 1 ♀, 1 ♂ (USNM), East Rhodope Mts, Kurdzhali District, Devesili, 4.06.1982 (P.B.). Tv = 6-7 (2 cases), 7-7 (4), 8-7 (1); *et* = 4-5 (1), 5-5 (3), 6-5 (1), 6-6 (1).

1 ♂ (No. 4), Pleven District, Bezhanovo, Georgicovata Cave, 11.10.1973 (A. Petkova). Tv = 7-8; *et* = 5-6.

5 ♀♀ (No. 108), 2 ♀♀, 3 ♂♂ (No. 113), Burgas District, Sv. Vlas, Emine, 22.08.1983 (K. Marincheva). Tv = 7-7 (2), 7-8 (3), 8-7 (3), 8-8 (2); *et* = 5-5 (1), 5-6 (1), 6-5 (1), 6-6 (6), 7-7 (1).

1 ♀ (No. 11), 8.05.1981; 2 ♀♀, 2 ♂♂ (No. 2), Blagoevgrad District, Paril, near Rupata Cave, 9.05.1981 (P.B. & S. Andreev). Tv = 7-7 (1), 7-8 (1), 8-7 (1), 8-8 (2); *et* = 5-5 (1), 6-6 (4); *em* = 4-4 (3), 4-3 (2).

2 ♀♀, 2 ♂♂, 1 ♂ juv. (No. 7), 2 ♀♀, 3 ♂♂ (No. 13, now in USNM), Blagoevgrad District, Ilinden, locality Pozlaka, 6.05.1981 (P.B., S. Andreev & V. Pomakov). Tv = 7-7 (3), 7-8 (2), 8-7 (3), 8-8 (2); *et* = 5-5 (10).

2 ♂♂, 1 ♀ juv. (No. 88), 1 ♂ (USNM), Blagoevgrad District, Melnik, 29.04.1983 (P.B., S. Andreev & V. Pomakov). Tv = 7-7 (3), 7-8 (2), 8-7 (3), 8-8 (2); *et* = 5-5 (10).

3 ♀♀, Blagoevgrad District, Goleshovo, near the karstic source, 10.05.1984 (P.B. & S. Andreev). Tv = 7-7 (1), 7-8 (1), 8-8 (1); *et* = 5-5 (1), 6-5 (1), 6-6 (1).

2 ♂♂ (No. 31), Blagoevgrad District, Musomishta, locality Grebenaro, litter (P.B. & S. Andreev). Tv = 7-7 (2); *et* = 5-5 (2).

2 ♀♀, 1 ♂ (No. 49), Mikhailovgrad (now Montana) District, Beli Mel, 13.06.1973 (P.B). Tv = 7-8 (1), 8-8 (2); *et* = 6-6 (3).

Greece

1 ♂ (No. 55). Thessaly, Mt. Olympus, 1700 m, 17.09.1974 (P.B. & V. Beshkov). Tv = 7-8; *et* = 6-6.

2 ♀♀ (No. 153). Macedonia, Drama District, Xiropotamos, 10.04.1993 (P.B.). Tv = 7-8, 8-8; *em* = 4-4, 4-5; *et* = 7-7, 5-5.

2 ♀♀, 1 ♂ (No. 168). Thrace, Evros District, Avas, 17.05.1987 (P.B.). Tv = 7-8 (2), 8-8 (1); *et* = 5-6 (1), 6-6 (1), 7-6 (1).

1 ♀ (No. 162). Thrace, Evros District, Essimi, 18.05.1987 (P.B.). Tv = 7-7; *et* = 4-5.

"Subgroup A2" (11 specimens). Tv usually 9 (82 % of the scored pedipalps, average 8,91). Te from 24 to 25 due to the variation of *et* from 6 to 7 (average 6,54) with a bimodal distribution (42 % have 6, and 58 % have 7).

Bulgaria

1 ♀ (No. 109), Sofia District, Rebrovo, 9.10.1980 (P.B.). Tv = 9-8; *et* = 6-6.

1 ♀ (No. 36), 1 ♀, 1 ♂ (USNM), Sofia District, Tserovo station, 24.05.1964 (P.B.). Tv = 9-9 (2), 8-9 (1); *et* = 6-6 (1), 7-7 (2).

4 ♀♀, 1 ♂ (No. 114), Sofia District, Zanoge, 1100-1300 m, 2.05.1985 (P.B.). Tv = 8-9 (1), 9-9 (3); *et* = 6-6 (3), 7-7 (1).

1 ♀, 1 ♂ (No. 45), Plovdiv District, Bachkovsky Monastery, 18.06.1960 (P.B.). Tv = 9-10 (1), 9-9 (1); *et* = 7-7 (2).

1 ♀ (No. 39), Veliko Turnovo District, Arbanasi, Lyaskovskata Cave, 6.08.1968 (P.B.). Tv = 9-9 (1); *et* = 7-7.

"Subgroup A3" (21 specimens). All indices are close to subgroup A2 but with a greater variance of Tv, usually from 8 to 10 (average 8,89), with a trimodal distribution (27 % of the scored pedipalps have 8, 37 % have 9, and 26 % have 10). Te from 24 to 25 due to the variation of *et* from 6 to 7 (average 6,40) with a bimodal distribution (44 % have 6, and 46 % have 7).

Greece, Aegean Islands (Kythira, Paros, Serifos, Iraklia, Amorgos, Kasos, Karpathos, Rhodes, and Crete)

1 ♀, 1 ♂ (No. 164), Kythira, Miteta, 28.04.1984 (P.B.). Tv = 9-8 (1), 9-9 (1); *et* = 5-6 (1), 6-6 (1).

2 ♀♀, 1 ♂ (No. 169), Kythira, Mylopotamos, 27.04.1987 (P.B.); 2 ♀♀ (No. 161), same locality, 9.05.1987 (P.B.). Tv = 7-8 (1), 8-8 (1), 8-9 (1), 9-9 (2); *et* = 6-6 (3), 6-7 (2).

1 ♀, 1 ♂ (No. 58), Paros, Marathi, cave - marble quarry, 23.12.1982 (P.B. & S. Andreev). Tv = 8-9 (1), 9-9 (1); *et* = 6-6 (1), 6-7 (1).

1 ♂ (No. 61), Iraklia, small cave, 15.09.1981 (P.B. & A. Bartsiokas). Tv = 8-9; *et* = 6-7.

1 ♂ (No. 1), Amorgos, Katapola, 13.09.1981 (P.B. & A. Bartsiokas). Tv = 8-8; *et* = 6-6.

1 juv. ♂ (No. 96), Kasos, Stylokamara Cave, 6.05.1984 (P.B.). Tv = 8-8; *et* = 6-6.

1 ♂ (No. 98), Karpathos, Archangel Michail, 1000-1215 m, 4.05.1984 (P.B.). Tv = 8-8; *et* = 6-6.

1 ♀, 1 ♂ (No. 40), Crete, Lefka Ori, 1500 m, 25.09.1974 (P.B.). Tv = 9-9 (1), 10-10 (1); *et* = 7-6 (1), 7-7 (1).

1 juv. ♂ (No. 41), Crete, Lefka Ori, 2200 m, 25.09.1974 (P.B.). Tv = 10-9; *et* = 7-7.

1 ♀, 1 juv. ♀, 1 ♂ (No. 115), Crete, Psiloritis, 1600-2000 m, 11.05.1984 (P.B.). Tv = 10-9 (1), 10-10 (1), 10-11 (1); *et* = 7-7 (2), 8-7 (1).

2 juv. ♀♀ (No. 56), Crete, Rethymnon District, Melidoni, 14.01.1968 (P.B.). Tv = 10-10 (1), 10-11 (1); *et* = 7-7 (1).

In addition to the island forms listed above under Subgroup A3, an unusual ♂ (No. 95, now in USNM) from Serifos (Coutalas, 0-300 m), 22.04.1984 (P.B.) has Tv = 7-7; *em* = 3-2; *et* = 5-5.

"Group B". A dark-colored form, with pronounced metasomal carination and coarse granulation and denticulation of carinae; with medium to high trichobothrial numbers on the pedipalp patella ("mesotrichous" or "polytrichous"). Tv varies from 9 to 12 (usually from 10 to 11). Te from 27 to 30; *et* varies from 7 to 8; *em* = 4 (rarely 5); eb_a = 5 to 6, *eb* = 5 to 6. Always *esb* = 2.

"Subgroup B1" (27 specimens). Tv varies from 9 to 10 (average 9,71) with an uneven bimodal distribution (23 % of scored pedipalps have 9, and 66 % have 10). Te from 27 to 29; *et* varies from 7 to 8 (average 7,22), with a bimodal distribution (70 % of scored pedipalps have 7, and 28 % have 8); eb_a varies from 5 to 6 (average 5,54), with a bimodal distribution (43 % of scored pedipalps have 5, and 54 % have 6). If not otherwise specified, *em* = 4-4, *eb* = 5-5.

Bulgaria

4 ♀♀, 1 ♀ juv. (No. 117), 2 ♀♀, 1♂ (USNM), Pazardzhik District, Gabrovnica, left bank of Maritsa, stream Dalbochitsa, 6.04.1986 (P.B.). Tv = 9-9 (3), 10-9 (1), 10-10 (4); *et* = 7-7 (3), 7-8 (2), 8-7 (2), 8-8 (1); *em* = 4-4 (7), 5-4 (1); eb_a = 5-5 (1), 5-6 (1), 6-5 (1), 6-6 (5); *eb* = 5-5 (7), 4-5 (1).

1 ♀, 1 juv. (No. 111), 2 ♀♀ (USNM), Blagoevgrad District, Petrich, 29.07. 1983 (K. Marincheva). Tv = 10-10 (3); *et* = 7-7 (3); eb_a = 5-6 (1), 6-6 (2).

2 ♀♀, 1 ♂♂ (No. 6), 1 ♀, 1 ♂ (USNM), Blagoevgrad District, Samuilovo, litter under *Castanea*, 11.05.1981 (P.B., S. Andreev & V. Pomakov). Tv = 10-10 (4), 8-9 (1); *et* = 7-7 (2), 8-6 (1), 8-8 (2); eb_a = 5-5 (3), 6-6 (1), 6-7 (1).

2 ♀♀, 1 ♂ (No. 110), Blagoevgrad District, Rybnitsa, 31.07.1983 (K. Marincheva). Tv = 9-8 (1), 9-9 (1), 8-9 (1); *et* = 7-7 (2), 6-7 (1); eb_a = 5-5 (3).

1 ♀ (No. 112), Blagoevgrad District, Melnik, 1.08. 1983 (K. Marincheva). Tv = 10-10; *et* = 7-7; eb_a = 5-5.

2 ♀♀, 1 ♂ (No. 3), Blagoevgrad District, waterfall near Kresna station, 14.05.1981 (P.B. & S. Andreev). Tv = 10-10 (2), 10-9 (1); *et* = 7-7 (3); eb_a = 5-5 (1), 6-6 (2); *eb* = 5-5 (2), 4-5 (1).

2 ♀♀, 1 ♂ (No. 87), Blagoevgrad District, Kresna, 30.04. 1983 (P. B. & K. Marincheva). Tv = 10-10 (2); 10-9 (1); *et* = 7-7 (3); eb_a = 5-5 (1), 6-6 (2).

"Subgroup B2" (34 specimens). Tv is usually 11 (in 78 % of all cases; average 11,0). Te from 29 to 30; *et* from 7 to 8 (average 7,61) with a bimodal distribution (40 % of scored pedipalps have 7 and 54 % have 8). Always *esb* = 2; if not otherwise specified, *em* = 4-4, eb_a = 6-6; *eb* = 6-6.

Albania

3 ♀♀ (No. 141), 2 ♀♀, 1 ♂ (No. 144), Shkoder District, Theth, 800-900 m, 28.05.1993 (P.B.). Tv = 11-11 (5), 11-12 (1); *et* = 7-7 (2), 7-8 (1), 8-7 (1), 8-8 (2); *em* = 4-4 (2), 5-4 (1); *eb* = 6-5 (1), 6-6 (5).

1 ♀, 1 ♂ (No. 133), 1 ♀ (No. 136), 2 ♀♀, 1 ♂ (No. 140), 1 ♀, 1 ♂ (No. 143), 1 ♀, 1 ♂ (No. 145), 2 ♀♀, 1 ♂ (No. 147), 2 ♀♀, 1 ♂ (USNM), Shkoder District, Boga, 1000-1100 m, 5-9.06.1993 (P.B. & B. Petrov). Tv = 11-10 (3); 11-11 (9), 12-10 (1), 12-11 (1), 12-12 (2); *et* = 7-7 (4), 7-8 (3), 8-7 (1), 8-8 (7), 9-9 (1); *em* = 4-4 (13), 5-4 (1), 4-5 (1), 5-5 (1); eb_a = 5-5 (1), 6-6 (14), 7-6 (1); *eb* = 5-5 (1), 6-6 (15).

2 ♀♀ (No. 148), Shkoder District, Boga, Maya Tchardakut, 1200-1400 m, 1.06.1993 (P.B.). Tv = 11-11 (1), 11-12 (1); *et* = 7-7 (1), 8-9 (1).

2 ♂♂ (No. 146), 1.06.1993; 2 ♂♂ (No. 139), 2.06.1993; Shkoder District, Boga,

Maya Tchardakut, 1400-1600 m (P.B.). Tv = 11-11 (4); *et* = 7-7 (1), 8-8 (3),

1 ♀, 3 ♂♂ (No. 138), Shkoder District, Mt. Radohimës, 1000-1100 m, 5-9.06.1993 (P.B. & B. Petrov). Tv = 10-10 (1), 10-11 (1), 11-11 (2); *et* = 7-7 (2), 7-8 (1), 8-8 (1); eb_a = 6-6 (3), 7-6 (1).

1 ♀ (No. 132), Rrëshen District, Merkurth, under stones, 11.06.1993 (P.B. & B. Petrov). Tv = 11-11; *et* = 7-7; *eb* = 5-5.

To the Group B also belongs one NMNHS sample from **Greece**: 2 ♀♀ (No. 68), Peloponnesos, Laconia, Mystras, 18.09.1983 (P.B. & V. Beshkov). Tv = 10-11 (1), 11-12 (1), *et* = 8-7 (1), 8-8 (1), *est* = 4-4 (2), *em* = 4-4 (2), eb_a = 5-5 (2), *eb* = 5-5.

"Group C". A dark-colored form, with strongly reduced but still traceable metasomal carination and reduced trichobothrial numbers. Tv varies from 6 to 7; Te = 21 to 22; *et* = 4 to 5; *em* = 3, *esb* = 4, em = 3, eb_a = 4, *eb* = 4.

Bulgaria

1 ♀ (No. 517), 2 ♀♀ (USNM), West Rhodope Mts, Smolian District, Trigrad area, Yagodina, 20.05.1983 (P.B.). Tv = 6-7 (1), 7-6 (1), 7-7 (1); *et* = 4-4 (1), 5-5 (2).

Comments. The species *Euscorpius carpathicus* (Linnaeus, 1767) (*sensu lato*) is the most widespread scorpion species in the Mediterranean (from Baleares to Crimea), and one of the most polymorphic species of scorpions in the world. It was described from the "Montibus Carpathicus", probably the Transylvanian Alps of the modern Romania (there are no scorpions in the northern and eastern Carpathian Mts). Kinzelbach (1975) quotes the information from the Linnean Society of London on the Tv = 8 in the alleged holotype ♀ (which would correspond to our Group A). During more than 200 years of taxonomic labors on *E. carpathicus*, over 30 taxa have been described (by such authorities as C. L. Koch, A. Birula, J. Hadzi, L. di Caporiacco) which are referable to this "species". Of these, almost 20 (!) are still formally valid "subspecies" (Caporiacco, 1950; Fet et al., in press). The variation within the species is enormous and quite poorly studied: no modern genetic techniques (chromosomal, allozyme or DNA) have been yet applied to solve taxonomic conundrums which surround *Euscorpius carpathicus*. The first allozyme and mitochondrial DNA data (Gantenbein et al., 1999; Gantenbein, Fet et al., in progress) indicate that there is a considerable variation and at least three separate lineages within this complex which are also closely grouped with a well-defined, separate species *E. italicus* (Herbst, 1800).

Our division of all analyzed Balkan specimens into phenotypic groups and subgroups comes from the realization that the existing criteria (based mainly on trichobothrial scores) are not sufficient for an adequate treatment of *E. carpathicus* complex. No solid criteria exist for delineation of subspecies (or even species) within this complex. Numerous authors who addressed this issue (Hadzi, 1929, 1930, 1931; Caporiacco, 1950; Ćurčić, 1972; Kinzelbach, 1975; Bonacina,

1983; SCHERABON, 1987; FET, 1986, 1997a) used different variable characters, which are often hard to assess and compare beyond a local population. Nevertheless, there are some common patterns, and the new information obtained on the basis of the NMNHS collection helps to clarify important "white spots" in the *E. carpathicus* taxonomic quagmire.

The existence of two groups of forms within *E. carpathicus* was noticed already by CAPORIACCO (1950) who discussed their distribution (mainly in Italy), and sorted all known combinations of morphological characters into an array of forms, splitting *E. carpathicus* in over than twenty subspecies. KINZELBACH (1975), on the other hand, pursued a "lumping" approach. He synonymized many of the known subspecies, and suggested (based on the Aegean region material) the existence of two separate (but hybridizing!) species which most likely correspond to our Groups A and B.

However, the evidence of KINZELBACH (1975) remained unclear since he: (a) analyzed only material from the Aegean area, while extrapolating his conclusions to the entire Mediterranean range of *Euscorpius carpathicus*; (b) used only meristic values of the Tv (ventral patellar trichobothrial series), leaving out much more variable Te (external patellar series); and (c) alleged an unconfirmed theory of hybridogenic origin for some of the *Euscorpius species*, in which intermediate meristic values simply were treated as "mixed characters". Also, KINZELBACH (1975) used an invalid name "*E. mesotrichus* Hadzi" to designate the dark, polytrichous form (species) corresponding to our Group B. This name, which cannot be used since it is a junior homonym (FET, 1997b), formally has a senior synonym, *E. tergestinus* (C. L. Koch) (type locality Trieste, Italy). However, the applicability of the latter name to the entire range of populations claimed by KINZELBACH (1975) is unclear at this moment. In fact, it is even unclear whether the Linnean name *E. carpathicus* is applicable beyond the Romanian populations from the Transylvanian Alps (a "nominotypic subspecies").

The taxonomy of *Euscorpius carpathicus* is far from being resolved. Some authors (e.g. MICHALIS, DOLKERAS, 1989; KRITSCHER, 1993) accepted Kinzelbach's division into two species; others did not (BONACINA, 1983; FET, 1997a; 1997b). Use of the formal subspecies categories without understanding of the genetic structure of a species is of a very limited value; besides, the criteria for subspecies delineation in *Euscorpius* are increasingly unclear. For the true understanding of the "*E. carpathicus*" problem(s), it is necessary to investigate numerous material from the entire range of this complex, with the application of all available (morphological as well as molecular) modern taxonomic techniques. Only then we could decide on the status of numerous, highly variable local forms of the "*E. carpathicus*" complex, and match these forms to the existing, valid names.

Meanwhile, important empirical observations can be certainly made on the Balkan material listed above, based mainly on the analysis of trichobothrial variation (including the new data on the variation in external patellar series).

The NMNHS material clearly falls into at least two major groups (our Group A and Group B), which most likely correspond to *E. carpathicus* (L., 1767) *sensu stricto* and "*E. mesotrichus* Hadzi" which KINZELBACH (1975) accepted as two species. These two groups are distinguished not only by coloration, morphosculpture, and trichobothrial scores in Tv series (in which two groups overlap), but first of all by the clear external trichobothrial "polytrichy" in the Group B (Te 27 to 30, *et* 7 to 8, eb_a 5 to 6, and *eb* 5 to 6) as compared to the Group A (Te 23 to 25, *et* 5 to 6, eb_a always 4, and *eb* always 4). This phenomenon deserves attention especially since the polytrichy in the *E. carpathicus* complex can be considered a derived feature (GANTENBEIN et al., 1999).

Group A and Group B exhibit geographic vicariance as well as local sympatry, as was correctly noticed by KINZELBACH (1975). In the NMNHS material, two groups are slightly overlapping in the southwestern Bulgaria, where Subgroup B1 penetrates from the south (i.e. from Greece) by two different routes: along the Struma (Strimonas) River valley (north to Kresna), and also independently along the Maritsa (Evros) River valley (north to Pazardzhik). These two biogeographic routes are common avenues of penetration of sub-Mediteranean elements into Bulgaria (P. Beron, personal communication).

Another subgroup (B2) of the Group B is for the first time described here from the material collected in the high mountains of the northwestern Albania (Prokletija massif). The Subgroup B2 represents one of the most "polytrichous" known populations of the *E. carpathicus* complex. This remarkable population not only has standard numbers of eb_a = 6 and *eb* = 6, but also sometimes exhibits *em* = 5, a case which so far has not been recorded for any form of the *E. carpathicus* complex. This increases the maximal confirmed Te (total number of external patellar trichobothria) in *E. carpathicus* to 31 (*et* = 8; *est* = 4; *em* = 5; *esb* = 2; eb_a = 6; *eb* = 6).

On the other hand, the "oligotrichous" Group A (or Kinzelbach's *E. carpathicus* sensu stricto) is not yet recorded from Albania, but is quite common in the northern and eastern Balkans. In the NMNHS collection, it is found (Subgroups A1 and A2) all over the territory of Bulgaria, north to Montana and Veliko Turnovo, and as far southeast as the Burgas District (Sveti Vlas near Nesebur, at the Black Sea coast). In the southwest (the Struma valley) this form is sympatric with the Subgroup B1; however, I found no evidence of their hybridization.

The Subgroup A3, represented in NMNHS by the material from many of the Aegean islands of Greece, roughly corresponds to what KINZELBACH (1975) considered a hybrid "subspecies" between his two species, to which he assigned the name *E. carpathicus candiota* Birula, 1903 (originally applied only to the Crete population). It is difficult to speculate on a possible hybridization as no evidence of such is known other than an increased Tv value (9-10 in the Subgroup A3 instead of 7-8 in the Subgroup A1 from Bulgaria and northeast Greece). It should be noted that the tendency to the increase of Tv is also expressed in some

northern, mainland populations from Bulgaria which I designated as a separate Subgroup A2 (close to A1 but exhibiting clear increase in Tv to 9-10). Further genetic investigation of the Group A populations should involve analysis of the material all over the Balkans, and also from the southern Turkey, Romania and Crimea. The isolated population of *E. carpathicus* from Crimea ("subspecies" *E. c. tauricus*) appears to be very close to the Bulgarian Subgroup A1, and could be a result of a recent (Pleistocene) migration from the eastern Balkans (FET, 1997a).

Finally, a single sample from the analysed NMNHS material ("Group C" from the West Rhodope Mts in the southern Bulgaria) stands clearly apart in the *E. carpathicus* complex (to which I currently place it on the basis of non-trichobothrial characters such as metasomal morphosculpture and leg setation). This form might represent an evolutionary trend opposite to the "polytrichy", namely a dramatic reduction of trichobothrial numbers (with Tv = 6 to 7, *et*=4 to 5, and *em*=3). The patellar trichobothrial formula of this population matches exactly that of some forms from the *E. mingrelicus* complex; however, its ratio *et - est / est - dsb* for the fixed finger is close to 1,0 which is characteristic for *E. germanus* rather than for *E. mingrelicus*. In fact, earlier I (FET, 1993) mentioned this form from Bulgaria as *E. germanus croaticus* Caporiacco, 1950. This issue requires further detailed investigation since my observations of the type of the latter form (from Velebit Mts, Croatia) shows that it does not appear to be close to *E. germanus* (C.L. Koch, 1837) but possibly belongs to the *E. carpathicus* complex as well. Although *em*=3 is a fixed character for *E. germanus* and *E. mingrelicus* complexes (VACHON, 1975), independent reduction of *em* series from 4 to 3 in rare cases has been recorded for the *E. carpathicus* complex, e.g. in *E. c. banaticus* (C.L. Koch, 1841) from Romania (BONACINA, 1983) and in an Aegean island specimen from Serifos (see above, with a reduction even to *em*=2-3). The Rhodope Group C might be a candidate for a "good" species; at this moment there is not yet enough evidence to present its description as such.

It is clear now, however, that the territory of Bulgaria houses an unexpected, previously unrecorded genetic diversity within the *E. carpathicus* complex, with at least three distinct phenotypic groups (A1 + A2, B1 and C). Further investigations of the unique, dynamic genetic system represented by the genus *Euscorpius* in Bulgaria, Albania, and Greece is warranted with the application of modern morphological and molecular techniques.

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Скорпиони (Arachnida, Scorpiones) от Балканския полуостров в колекциите на Националния природонаучен музей в София

Виктор ФЕТ

(Резюме)

Върху скорпионите на Балканския полуостров са публикувани множество трудове, но тяхната систематика остава неясна, особено на полиморфния род *Euscorpius*. Анализирани са 173 скорпиона от арахнологичните колекции на Националния природонаучен музей при БАН в София, предоставени от П. Берон. Те включват видовете *Mesobuthus gibbosus* (Brullé) от Албания и Гърция, *Euscorpius beroni* sp. n. от Албания, *E. carpathicus* (L.) s. lato от България, Албания и Гърция и *Iurus dufoureius* (Brullé) от Гърция (Пелопонес и островите Касос и Родос). Полиморфният вид *E. carpathicus* (L.) е разделен на фенотипни групи и подгрупи, които са описани, без да им се дават имена. Описан е новият вид *Euscorpius beroni* sp.n. от Северна Албания (Алпет), който е най-високо живеещият скорпион в Европа и е симпатричен с *E. carpathicus* (L.).

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Albanotrechus beroni, nuovo genere nuova specie di Trechini cavernicoli di Albania (Coleoptera, Carabidae)

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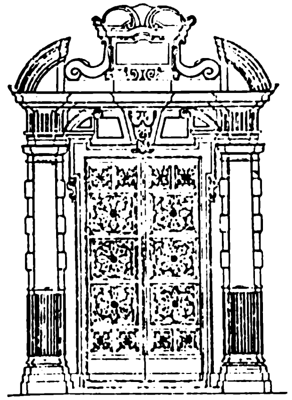

ESTRATTO

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Achille CASALE* - Vassil B. GUÉORGUIEV**

Albanotrechus beroni, nuovo genere nuova specie di Trechini cavernicoli di Albania (Coleoptera, Carabidae)

ABSTRACT

Albanotrechus **(n. gen.)** ***beroni*** **n. sp., new genus and new species of troglobitic Trechini from Albania (Coleoptera, Carabidae).** ***Albanotrechus*** **(new genus)** ***beroni*** **n. sp., a new troglobitic trechid beetle, is described from central Albania, on specimens collected in the cave "Spela Merkurth", Rreshen district.**

The systematic relationships and the diagnostic characters of the genus, related to ***Aphaenopsis*** **G. Müller, 1913 of the "*Aphaenops* phyletic line" in the widest sense of Jeannel, are illustrated. The limits of this phyletic series and the characters of the dinaric-dalmatian genera near** ***Albanotrechus*** **are also discussed.**

INTRODUZIONE

Nel corso degli ultimi anni alcune spedizioni speleologiche provenienti da diversi paesi europei, con intenti anche biospeleologici, si sono avvicendate in Albania, paese assai poco conosciuto e praticamente chiuso agli stranieri dalla seconda guerra mondiale ad oggi. Non casualmente gran parte delle nostre scarse conoscenze sulla fauna cavernicola di quel paese risalgono agli anni anteriori al 1945 (Carabidi e Colevidi ipogei furono anche raccolti dai nostri Boldori, Capra, Lona, Pomini, Ravasini, nel periodo dell' occupazione italiana). È lecito dunque prevedere che molti nuovi organismi, di diversi gruppi animali, si debbano aggiungere in un prossimo futuro alla speleofauna di

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questa interessantissima area dalmato-dinarica, con il procedere delle esplorazioni dell'ambiente sotterraneo sia superficiale, sia profondo. Scopo di questo lavoro è far conoscere un nuovo, interessantissimo Trechino ipogeo raccolto in Albania, nel corso di una recente spedizione bulgara, dal nostro amico e collega Peter Beron, del Museo Zoologico di Sofia: a lui vanno i nostri più sentiti ringraziamenti per avercelo affidato in studio. La posizione sistematica e l'interesse zoogeografico del nuovo taxon saranno discussi nel capitolo conclusivo.

ALBANOTRECHUS nov. genus

Specie tipo: *Albanotrechus beroni* n. sp.

DERIVATIO NOMINIS

Dalla patria della specie-tipo. Il genere è maschile.

Genere di Trechini della linea filetica di *Aphaenops* (nel senso lato di Jeannel, 1928, e di Casale e Laneyrie, 1982, ma con le precisazioni restrittive di Vigna Taglianti e Sciaky, 1988, che verranno discusse oltre), di dimensioni medio-grandi (mm 7.30-8.00), depigmentati, anoftalmi, apparentemente glabri ma con tempie e sterni addominali pubescenti e con rade, brevi setole sugli intervalli elitrali. Corpo allungato, con elitre convesse (fig. 1). Labium libero, con dente mediano bifido; submento provvisto di 6 setole (fig. 2).

Pronoto fortemente ristretto alla base, con angoli posteriori acuti e salienti all'indietro e privo di setola basale. Gruppo omerale della serie ombelicata con prima setola spostata sul disco elitrale, arretrata circa a livello della seconda. Sterni addominali provvisti di setole supplementari. Appendici allungate ma robuste; protibie pubescenti, solcate sul lato esterno e finemente rugose, strigose sul lato dorsale; protarsi nei ♂♂ con due primi articoli dilatati e dentati sul margine interno.

Edeago (fig. 3) con regione distale ben differenziata, adunca sul lato dorsale, e con bulbo basale grande, provvisto di carena sagittale sviluppata; parameri grandi, larghi, appena ristretti all'apice, provvisti di 4-5 setole distali. Endofallo con piccolissima lamella copulatrice stiloide e pacchi di squame in posizione mediana e distale. Gonostili come da fig. 5.

Vicino ad *Aphaenopsis* G. Müller, 1913 (nel senso ristretto e riveduto di Vigna Taglianti e Sciaky, 1988, e di Monguzzi, 1993, non di Pretner, 1959) per numerosi caratteri, quali la struttura generale del capo (non orbicolare tuttavia in *Albanotrechus*), con antenne allungate ma robuste e con sclerite prebasilare (submento) munito di 6 setole; per la forma del pronoto, ristretto posteriormente, con angoli anteriori prominenti e posteriori acuti e salienti, con

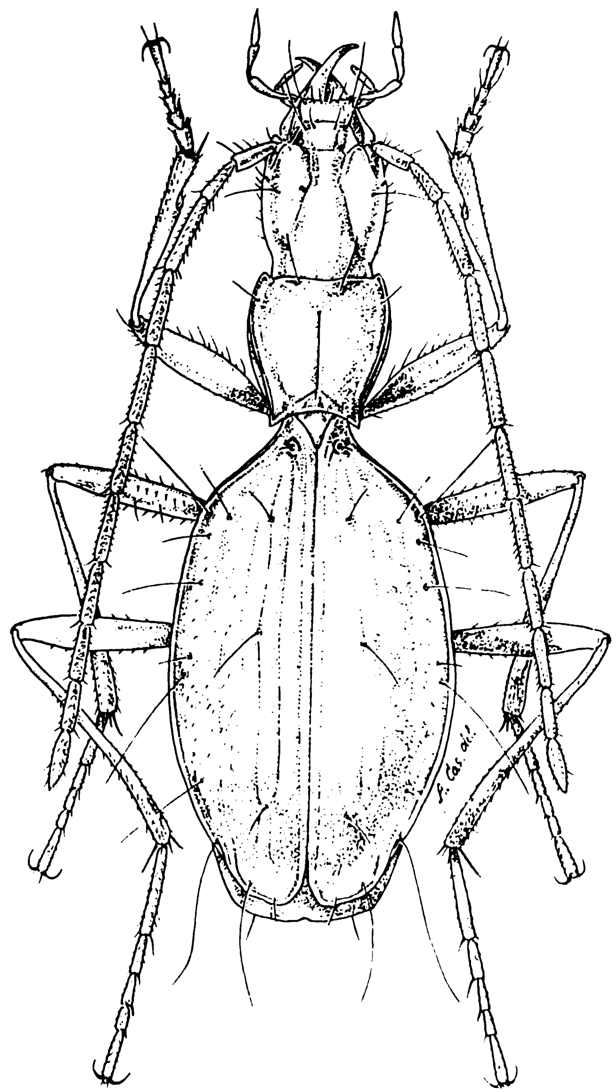


Fig. 1 - *Albanotrechus* (n. gen.) *beroni* n. sp., holotypus ♂, habitus.

setola marginale anteriore spostata in avanti e basale assente; per la struttura delle elitre, con strie interne profonde, provviste di due setole discali e di una preapicale inserite sulla terza stria e di un gruppo omerale "disaggregato", con 1° poro setigero migrato all'interno, inserito circa a livello del 2° poro e 4° nettamente distanziato dal 3°.

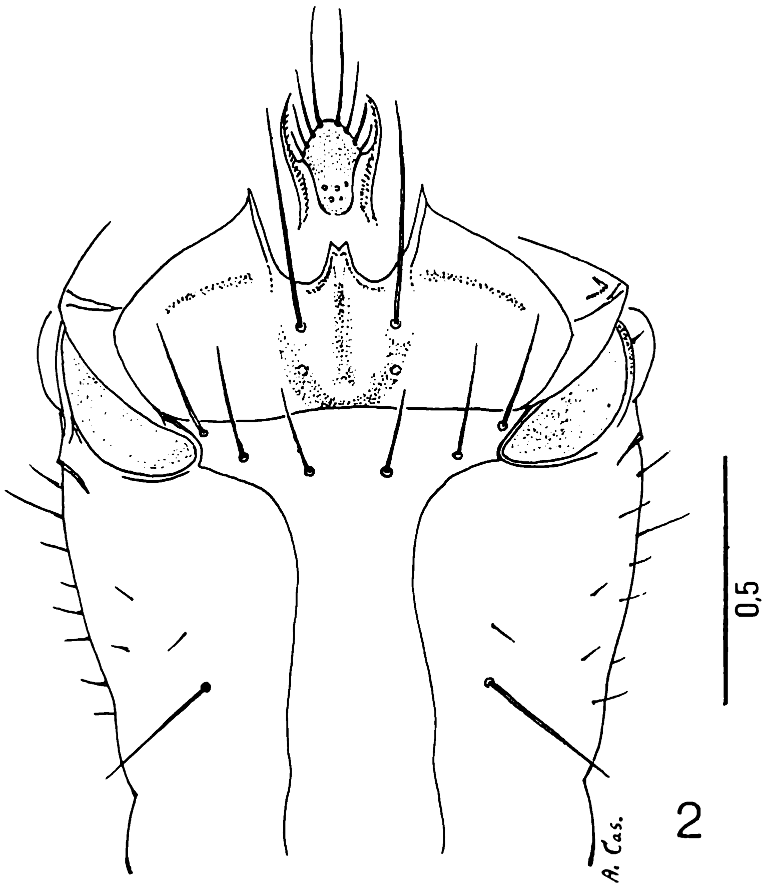
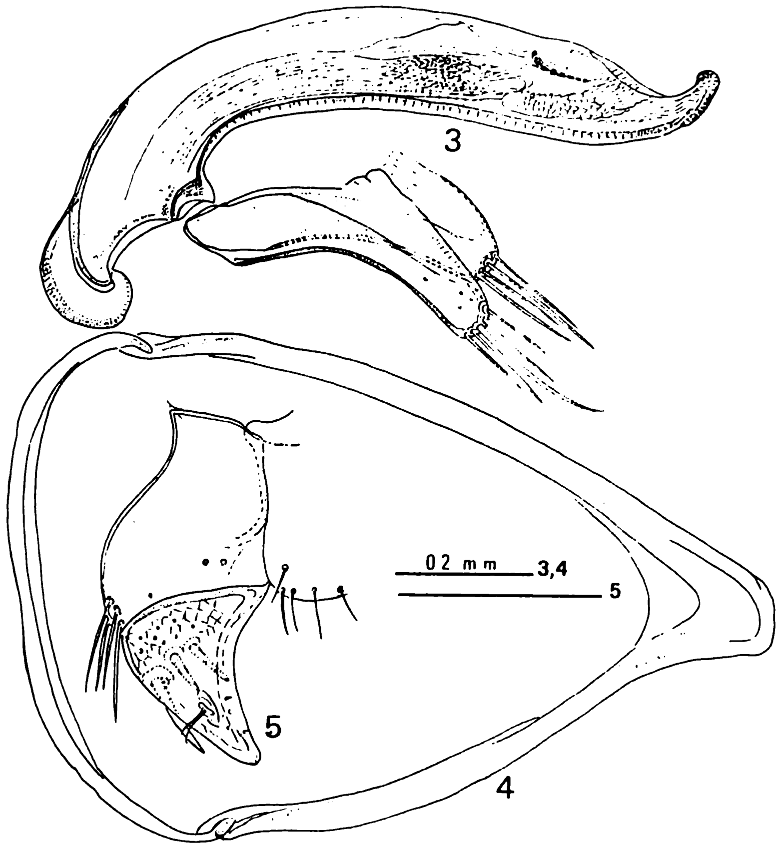


Fig. 2 - *Albanotrechus beroni*, paratypus ♂, lato ventrale del cranio e labbro inferiore (scala in mm.).

Ben distinto tuttavia dal suddetto genere per la struttura generale non afenopsiana, per il dente labiale bifido, per le tibie anteriori solcate, per la presenza di pubescenza sulle elitre e sulle tempie, per gli sterni addominali provvisti di setole supplementari, e particolarmente per la conformazione generale dell'edeago, allungato e sinuoso, con apice adunco e differenziato e con sacco interno munito di lamella copulatrice piccola e poco differenziata (grande e allungata in *Aphaenopsis*).

Ben distinto infine dagli altri generi vicini ad *Aphaenopsis* per i caratteri evidenziati nelle osservazioni conclusive.



Figg. 3-5 - *Albanotrechus beroni*, holotypus ♂, edeago in visione laterale (3), IX urite (4); paratypus ♀, gonostilo sinistro in visione ventrale (5).

Albanotrechus beroni n. sp.

Materiale tipico: *Holotypus* ♂: Albania, Distr. Rreshen (Risheni), v. Merkurth, Spela Merkurth, 11.6.1993, P. Beron et B. Petrov leg. (coll. Museo reg. Scienze naturali, Torino). *Paratypi* (stessi dati dell'olotipo): 1 ♀ (coll. A. Casale), 1 ♀ (coll. V. B. Guéorguiev), 1 ♀ (coll. P. M. Giachino), 1 ♂ (coll. L. C. Genest), 1 ♂ (coll. Museo di Zoologia, Sofia).

Corpo allungato ma non gracile, con elitre subconvesse; habitus di Trechino molto specializzato alla vita ipogea, ma non afenopsiano (fig. 1), anoftalmo, depigmentato, con ali metatoraciche completamente ridotte. Appendici allungate ma robuste.

Dimensioni relativamente grandi (LT: mm 7.30-8.00; 7.80 nell'olotipo). Colore fulvo testaceo uniforme. Tegumenti lucidi, con microscultura percettibile in maglie poligonali sul capo e in maglie trasversali, più svanite, sul pronoto e sulle elitre.

Capo grande, ovalare allungato, non globoso, più stretto del pronoto; tempie regolarmente convesse, cosparse di poche setole brevi, erette, distanziate; costrizione collare distinta ai lati, svanita dorsalmente; solchi frontali completi, profondi nel terzo anteriore, divergenti lungo l'area cerebrale, progressivamente più superficiali ma ancora distinti nel tratto compreso fra il secondo poro sopraorbitale e la costrizione collare. Due setole sopraorbitali presenti per lato, su linee debolmente convergenti all'indietro. Occhi assenti, linea preoculare distinta. Margine anteriore dell'epistoma e solco clipeo-frontale subrettilinei. Epistoma con 4 setole. Antenne allungate (LA in HT: mm 6.10), ma con antennomeri robusti, pubescenti dalla base del 2° articolo, non raggiungenti, distese, l'apice delle elitre; articolo I poco ispessito, con lunghe setole erette lungo il margine anteriore, II lungo circa quanto il primo, appena allargato all'apice, III di 1 volta e 1/3 più lungo del II; rimanenti antennomeri non assottigliati, di lunghezza progressivamente e regolarmente decrescente, i mediani distintamente compressi, l'ultimo conico all'apice. Mandibole lunghe, subrettilinee nel tratto prossimale, falcate all'apice. Palpi mascellari senza particolari caratteristiche, con ultimo articolo lungo circa quanto il penultimo. Labium (fig. 2) libero, articolato allo sclerite prebasilare, con dente mediano saliente, smarginato e bifido all'apice; palpi labiali con secondo articolo dicheto; ligula con margime libero prominente, provvista di 2 setole maggiori subapicali e di 3 setole su ciascun lato, di lunghezza progressivamente decrescente; paraglosse gracili. Submento munito di 6 setole disposte come in fig. 2.

Pronoto subcordiforme, circa tanto lungo quanto largo (ratio lungh. max./largh. max: 0.9), con massima larghezza all'altezza del quarto anteriore, posteriormente all'inserzione delle setole marginali anteriori; lati arcuati in avanti, convergenti verso la base, subsinuati solo anteriormente agli angoli posteriori che sono acuti, vivi e salienti all'indietro e verso l'esterno; doccia marginale completa e ben delimitata. Setola basale assente. Pro-epipleure visibili dal lato dorsale nei 3/4 prossimali.

Elitre ovalari allungate, molto strette e peduncolate alla base, con massima larghezza appena oltre la metà, convesse ma incavate nell'area iuxtascutellare; margine preomerale sviluppato e fortemente obliquo rispetto alla linea mediana, omeri arrotondati ma ancora indicati; doccia marginale larga e profonda, ristretta nel tratto preomerale; margini rilevati, quasi carenati; carena apicale ben sviluppata, lobi apicali separatamente e ottusamente convergenti all'angolo suturale. Strie tutte riconoscibili, finemente ma distintamente punteggiate, più profonde le quattro interne, progressivamente svanite quelle più esterne; striola iuxtascutellare assente; stria ricorrente apicale molto profonda, diretta verso l'apice della quinta stria. Intervalli subconvessi, gli esterni con tracce di brevissima, sparsa pubescenza dorata, visibile solo a luce radente.

Chetotassi: poro iuxtascutellare presente. Gruppo omerale della serie ombelicata di quattro setole disaggregate: la 1ª molto spostata sul disco e arretrata circa a livello della 2ª; quest'ultima prossima alla doccia laterale, circa equidistante dalla 1ª come dalla 3ª; 3ª e 4ª scostate dal margine laterale, la 4ª a una distanza dalla 3ª doppia rispetto a quella che separa quest'ultima dalla 2ª; gruppo mediano di due setole (5ª e 6ª) poste circa a metà lunghezza, molto vicine fra loro, la 5ª nettamente più scostata dalla doccia mediana rispetto alla 6ª; 7ª e 8ª molto distanziate, a una distanza reciproca pari o superiore a quella che separa la 3ª dalla 4ª, la 7ª scostata dalla doccia marginale, l'8ª inserita alla base della carena apicale. Gruppo discale di due setole inserite sulla 3ª stria, la 1ª in posizione molto anteriore, circa a livello della 1ª setola del gruppo omerale, la 2ª anteriormente al livello di inserzione della 5ª setola della serie ombelicata. Triangolo apicale completo: setola anteriore in posizione molto arretrata, discale, inserita all'anastomosi della 2ª con la 3ª stria; setola esterna presso la carena apicale, setola apicale piccola, breve, inserita all'esterno dell'angolo suturale.

Zampe allungate ma robuste. Pro e mesofemori provvisti di setole lunghe, erette, allineate lungo il margine anteriore del lato ventrale e lungo il lato dorsale; protibie pubescenti, finemente solcate sul lato esterno, rugose, strigose sul lato dorsale. Tarsi anteriori nel ♂ con articoli I e II dilatati e dentati sul lato interno, muniti di fanere adesive ventrali. Articolo IV di pro e mesotarsi privo di tubercoli o di fanere ventrali. Sterni addominali pubescenti, ciascuno con 23 setole posteriori per lato, il VII con 1 (♂) o 2 (♀) setole per lato. Segmento addominale IX (fig. 4) molto grande in rapporto alle dimensioni dell'edeago.

Edeago (fig. 3) lungo mm 0.95, regolarmente arcuato, sinuoso, con lama distale fortemente differenziata, spatolata e adunca sul lato dorsale. Bulbo basale moderatamente differenziato, carena sagittale ben sviluppata. Parameri grandi, larghi, appena ristretti all'apice, ciascuno con 45 setole distali. Sacco interno quasi inerme, munito di una piccolissina lamella copulatrice

poco chitinizzata, stiloide, adagiata sul lato destro dell'endofallo, dorsale rispetto a due pacchi di squame embricate posti **rispettivamente in posizione** mediana e distale.

Gonostili della ♀ senza particolari caratteristiche: segmento apicale munito di tre setole spiniformi sul lato tergale e di fossetta sensoria, con 2 setoline, in posizione subapicale sternale (fig. 5).

Derivatio nominis

Dedichiamo in segno di amicizia e stima questa nuova interessante specie al suo scopritore, il Dr. Peter Beron, del Museo di Zoologia dell'Accademia delle Scienze di Sofia, valentissimo speleologo e infaticabile viaggiatore, che con la consueta cortesia volle affidarcela in studio.

Distribuzione, Ecologia

Tutti gli esemplari noti del nuovo taxon sono stati raccolti nella grotta "Spela Merkuthi" (Albania centrale, distretto Risheni, villaggio Merkuth sul fiume Uraka, m 1000 circa di quota). Si tratta di una grotta orizzontale, lunga circa 550 m, con alcuni laghi, grandi sale e abbondante argilla.

Osservazioni

Non può sfuggire l'interesse sistematico e biogeografico che comporta la scoperta di un nuovo genere di Trechini ipogei in un settore così poco conosciuto dell'area dinarico-balcanica. Il fatto che tale scoperta sia avvenuta poco tempo dopo e a non grande distanza geografica da quella di un altro taxon, *Dalmataphaenops chiarae* Monguzzi, 1993 (del Biokovo Planina), relativamente affine ma molto più specializzato, dimostra da un lato la necessità di ulteriori ricerche per una più approfondita conoscenza della fauna cavernicola della regione, ma fornisce per contro ulteriori elementi per una più completa e dettagliata discussione dei caratteri morfologici che caratterizzano i generi affini della linea, o "serie" filetica, cui *Albanotrechus beroni* appartiene.

Un primo aspetto della questione riguarda essenzialmente i limiti, più o meno lati, che si vogliono dare alla linea in causa, e al concetto stesso di "serie filetica" nel senso originale di Jeannel (coincidente, in larga misura, con quello di "track" di Croizat: cfr. Casale, 1988). Il genere *Aphaenopsis* è stato attribuito da Jeannel ad una "linea filetica di *Aphaenops*" assai ricca di generi e specie e ad ampia distribuzione geografica, con valide documentazioni: «On trouve chez les *Aphaenopsis* d'importants caractères qui rappellent ceux des *Aphaenops* pyrénéens. Leur organe copulateur est tout à fait du même type... Commes les *Aphaenops*, les *Aphaenopsis* ont le dent labiale unifide; l'état de leur série ombiliquée et de leurs sillons frontaux sont semblables. Les palpes ont la même forme e le prébasilaire porte 6 soies dans les deux genres.... Sans doute les deux genres ont ils eu une origine commune. Ils sont les survivants d'une lignée de Trechini qui a du se répandre de l'Egéide aux Pyrénées avant le début des effondrements tyrrheniens....».

Un senso molto lato alla serie filetica di *Aphaenops*, di Trechini "anisotopi" con primi due articoli dei tarsi anteriori maschili dilatati, sostanzialmente coincidente con quello attribuito ad essa da Jeannel, è stato mantenuto da Casale e Laneyrie (1982). Più di recente Vigna Taglianti e Sciaky (1988)e Sciaky e Vigna Taglianti (1990) hanno giustamente evidenziato il fatto che alcune delle serie filetiche di Jeannel, o dei gruppi di generi di Casale e Laneyrie, si presentano, con l'aumentare delle nostre conoscenze, sempre più eterogenei.

Tale opinione può essere largamente condivisa: molti generi e/o specie presentano in comune talora più caratteri adattativi di elevata specializzazione, o caratteri primitivi, plesiomorfi (vedasi la presenza di due articoli dilatati nei protarsi dei ♂♂), che non reali sinapomorfie.

D'altro canto ciò non pare contradditorio con una possibile monofilia della serie filetica di *Aphaenops* nel senso originario di Jeannel: non vi è alcun dubbio che all'interno di tale "linea" sia possibile raggruppare generi affini fra loro in gruppi assai più omogenei, così come è evidente che alcuni caratteri (stato afenopsiano, "disaggregazione" del gruppo omerale della serie ombelicata e molti altri) si ripropongano per convergenza in taxa non direttamente affini all'interno della linea in causa, e in altre linee di Trechini ipogei (di *Neotrechus*, per esempio). Riteniamo ciononostante che la possibilità di un'origine comune dei membri attuali della linea in causa nell'area euro-mediterranea, pur oggi così differenziati morfologicamente e distribuiti dalla Penisola Iberica all'area egeica e caucasico anatolica, nei settori di "rifugio" e di più antico popolamento, non sia affatto da escludere, e che la linea filetica di *Aphaenops* (con debita esclusione di alcuni generi extraeuropei, quali *Hymalaphaenops*) possa essere ancora considerata, malgrado tutto, un'unità monofiletica.

Il discorso appare più semplice se si confrontano i generi e le specie dell'area balcanico-dinarica vicini a *Albanotrechus beroni*: tale analisi è oggi agevolata grazie anche ai recenti lavori di Monguzzi (1993) e di Vigna Taglianti e Sciaky (1988). Sono stati infatti evidenziati e discussi, dai suddetti autori, sia le inesattezze relative alla morfologia di alcuni taxa fornite da Jeannel (1928), sia l'eterogeneità di un genere *Aphaenopsis* nel senso di Pretner (1959), includente cioè anche, a livello subgenerico, *Scotoplanetes* Absolon, 1913 (a cui afferiscono specie glabre con corpo allungato e mandibole slanciate e diritte), e *Adriaphaenops* Noesske, 1928 (a cui afferiscono specie completamente pubescenti).

Appare ora chiaro che questi ultimi tre generi distinti, con *Albanotrechus*

qui descritto e *Dalmataphaenops* Monguzzi (1), formano un gruppo omogeneo, differenziatosi nel settore geografico compreso fra le catene dinariche costiere e i massicci carsici delle attuali Bosnia-Erzegovina, Montenegro e Albania (cfr. Pretner, 1959; Pavićević, 1990).

All'interno del gruppo risultano particolarmente evidenti i caratteri differenziali di *Dalmataphaenops* (fra gli altri, chiare plesiomorfie quali la serie ombelicata "aggregata" lungo la doccia marginale, accanto a peculiari apomorfie quali lo sclerite prebasilare munito di setole sovrannumerarie, oltre al massimo livello di specializzazione afenopsiana del corpo). Più interessante appare un confronto fra *Aphaenopsis* e *Albanotrechus*, che paiono, come è stato evidenziato nella diagnosi iniziale, più strettamente affini. I caratteri differenziali di *Albanotrechus* risultano chiari a due livelli: a livello di specializzazione morfologica, che nel suddetto genere appare più primitiva, per il corpo non afenopsiano, per il capo non orbicolare con solchi frontali completi, per il pronoto cordiforme con angoli posteriori acuti e salienti, per le elitre con omeri ancora indicati, più simile pertanto morfologicamente ad *A. pfeiferi* (Apfelbeck, 1908) che non ad *A. apfelbecki* (Ganglbauer, 1891). In *Albanotrechus* inoltre le tempie, gli sterni addominali e le interstrie elitrali presentano tracce di pubescenza, presente in *Aphaenopsis* solo sul lato sternale, ma sviluppata su tutto il corpo, pronoto compreso, in *Adriaphaenops*. Per contro, nelle specie attribuite ad *Aphaenopsis* le antenne sono meno allungate e più ispessite che in *Albanotrechus*.

Caratteri diacritici non adattativi sono invece, in *Albanotrechus*, il dente labiale bifido (come in *Dalmataphenops*; unifido in *Aphaenopsis*), le tibie anteriori solcate (non solcate in *Aphaenopsis*), la presenza di setole sovrannumerarie sugli sterni addominali, e la struttura peculiare dell'edeago, con lama apicale molto sviluppata e uncinata sul lato dorsale e con lamella copulatrice estremamente ridotta (in *Aphaenopsis*, l'edeago è piccolo e ispessito, con apice semplice; la lamella copulatrice è invece grande, larga e ovalare, concoide). La struttura dei parameri è molto simile nei due generi.

Albanotrechus beroni presenta dunque, all'interno dei generi dalmato-dinarici qui ricordati, il più basso livello di specializzazione all'ambiente sotterraneo, con una combinazione di caratteri sia primitivi (tracce di pubescenza, solchi frontali completi, presenza di sei setole sullo sclerite prebasilare, omeri indicati), sia derivati o specializzati (chetotassi elitrale modificata, dente labiale bifido, struttura peculiare dell'edeago e atrofia della lamella copulatrice), che ben ne giustifica l'isolamento in un genere a se stante, isolato, allo stato attuale delle nostre conoscenze, nel settore più meridionale dell'area complessiva in cui i generi suddetti sono distribuiti. La differenziazione (per isolamento e vicarianza, a livello specifico e generico), dei diversi taxa qui discussi, in massicci calcarei profondamente carsificati, trova importanti analogie nella medesima area con una ricca e variatissima fauna ipogea, esito di faune terziarie sopravvissute in ambiente sotterraneo al deterioramento climatico e alla xericità ambientale plio-pleistocenici, generalizzati nel bacino del Mediterraneo, ma non coinvolte, o coinvolte solo marginalmente, dal Glacialismo Quaternario.

(1) L'amico e collega Branko Jalžić di Zagabria, a cui vanno i nostri più vivi ringraziamenti, ci ha inviato recentemente un esemplare ♂ di *Dalmataphaenops chiarae* della grotta "Jama pod Kamenitin vratima, Ladana (Biokovo)". Si tratta della seconda località conosciuta di questa specie, oltre a quella tipica.

RIASSUNTO

Gli Autori descrivono *Albanotrechus* (n. gen.) *beroni* n. sp., nuovo Trechino cavernicolo recentemente scoperto in Albania centrale nella grotta "Spela Merkurth" nel distretto di Rreshen.

Vengono evidenziati la posizione sistematica e i caratteri differenziali del nuovo genere, affine ad *Aphaenopsis* G. Müller, 1913, della "linea filetica di *Aphaenops*" nel senso lato di Jeannel. Vengono poi discussi il significato e i limiti della suddetta serie filetica e i caratteri dei generi dalmato-dinarici vicini ad *Albanotrechus*.

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